

A review of *Crotalaria* L. (Fabaceae: Crotalarieae) in Australia

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Summary

Holland, A.E. (2001), A review of *Crotalaria* L. (Fabaceae: Crotalarieae) in Australia. *Austrobaileya* 6 (2): 293–324. The genus *Crotalaria* L. in Australia is examined, and a new record noted: *Crotalaria prostrata* Rottl., new combinations are made: *Crotalaria cunninghamii* subsp. *sturtii* (*C. sturtii* R.Br.), *Crotalaria dissitiflora* subsp. *benthamiana* (*C. benthamiana* Pritzel), *Crotalaria novae-hollandiae* subsp. *crassipes* (*C. crassipes* Hook.) and *Crotalaria montana* var. *exserta* (*C. exserta* Domin). New varieties and subspecies are described: *Crotalaria medicaginea* var. *linearis*, *Crotalaria aridicola* subsp. *glabrata* and *C. aridicola* subsp. *densifolia*. Lectotypes are chosen for *Crotalaria cunninghamii* R.Br., *Crotalaria crispata* Benth., *Crotalaria brevis* Domin and *Crotalaria aridicola* Domin. A neotype is chosen for *C. benthamiana* Pritzel. A key to the species occurring in Australia is provided.

Keywords: *Crotalaria*, *Crotalaria prostrata*, *Crotalaria humifusa*, *Crotalaria mysorensis*, *Crotalaria membranacea*, *Crotalaria crispata*, *Crotalaria ramosissima*, *Crotalaria brevis*, *Crotalaria cunninghamii*, *Crotalaria sturtii*, *Crotalaria dissitiflora*, *Crotalaria benthamiana*, *Crotalaria novae-hollandiae*, *Crotalaria crassipes*, *Crotalaria montana*, *Crotalaria linifolia*, *Crotalaria exserta*, *Crotalaria medicaginea*, *Crotalaria trifoliastrum*, *Crotalaria aridicola*, Australia.

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Introduction

Crotalaria L. is a genus of c. 600 tropical and subtropical species most of which occur in tropical Africa (Polhill 1982). *Crotalaria* species, often called rattlepods, are herbs or shrubs with leaves simple, unifoliolate or digitately 3–7-foliolate. Flowers are in terminal, leaf-opposed or axillary racemes with bracts and bracteoles usually present. Flowers are usually yellow and red or brown veined, rarely mauve. The keel petal is prominently angled distally upwards. Stamen filaments are connate proximally into a tube open on the upper side, with long and short anthers alternating. Fruits are inflated and dehiscent and not septate, the seeds loose and “rattling” in the dry pod. Many species are known to be toxic, and some are used for fibre and green manure (Polhill 1982; Rudd 1991; Everist 1974).

In Australia, there are 36 species including 23 subspecies and varieties. Sixteen species of these are naturalised. Twenty species are considered to be native (or of pre-European introduction), 9 of which are endemic and 11 are widespread through SE Asia and India as

well as northern Australia, New Guinea and Indonesia. Of the endemic species, 4 belong to *C.* sect. *Hedriocarpae* Wight & Arn, 2 to *C.* sect. *Calycinae* Wight & Arn., 2 to *C.* sect. *Crotalaria* and 1 to *C.* sect. *Dispermae* Wight & Arn. (Polhill 1982 - see key to Sections below).

Lee (1979) revised some of the complex endemic Australian species groups: *C. eremaea*, *C. dissitiflora* and *C. novae-hollandiae*. This work is taken a step further here, partly as a consequence of new material becoming available since Lee’s work. Also, results of studies on some of the widespread Asian/Australian species complexes, i.e. the groups *C. medicaginea/C. trifoliastrum*, and *C. montana/C. nana/C. melanocarpa*, are here reported in relation to the Australian material. In order to account for the variation occurring in the Australian material in these two groups, new infraspecific taxa are described, and *C. aridicola* Domin and *C. brevis* Domin are circumscribed.

Materials and Methods

Herbarium specimens from AD, BM, BRI, CANB, DNA, K, MEL, NSW, P and PERTH

were examined. These examinations were augmented with field observations where possible. The shape, size and colour variation of petals are best observed in fresh material. Polhill (1982) used receptacle, calyx, standard, keel and style characters to distinguish the sections of the genus. Lee (1978) mainly used flower size and shape, leaf shape and hair characters to separate species and subspecies. Unifoliolate species usually have longer petioles than those with simple leaves, and have a distinct articulation near the petiole apex (also see discussion under *C. cunninghamii* below). Stipules, if present, vary enormously in shape and size. Some species have caducous stipules, so that the immature shoots need to

be examined. Bracts, found at the base of the pedicels, are often similar in appearance to the stipules, and may also be caducous. Bracteoles can occur on the calyx or variously positioned on the pedicel. The calyx lobe length, in relation to the calyx tube, is measured on the upper lobes except as otherwise stated. The calyx is often persistent in fruit. Petal measurements follow Lee (1978, 328), although only length and width are recorded here. Polhill (1982) and Niyomdham (1978) give more detailed information on characters and character states in *Crotalaria*. The concepts of subspecies and varieties used here are those of Davis & Heywood (1963).

Key to the Sections of *Crotalaria* in Australia

(adapted from Polhill, 1982: * indicates a naturalised taxon)

1. Beak of the keel petal not or slightly spirally twisted (up to 90°) 2
Beak of the keel petal spirally twisted through more than 120° 4
2. Receptacle (hypanthium) prominent, 3–9 mm long; keel 1.6–5.5 mm long;
calyx tips joined in bud; pod long stipitate.
..... **C. sect. Grandiflorae** (Bak.f.) Polhill (**C. agatiflora*, **C. laburnifolia*).
Receptacle up to 2 mm long, keel, calyx and legume not as above 3
3. Calyx 0.7–1.3 times as long as the keel, stipules often foliaceous
..... **C. sect. Chrysocalycinae** (Benth.) Bak.f. (**C. incana*, **C. goreensis*)
Calyx up to half as long as the keel petal; stipules not foliaceous
..... **C. sect. Hedriocarpae** Wight & Arn. (*C. dissitiflora*, *C. eremaea*, *C. smithiana*,
C. mitchellii, **C. pallida*, **C. ochroleuca*, **C. zanzibarica*, **C. lanceolata*, **C. micans*)
4. Calyx 2-lipped with a short upper lip, subequal to the corolla
..... **C. sect. Calycinae** Wight & Arn. (*C. alata*, *C. calycina*, *C. sessiliflora*,
C. humifusa, **C. prostrata*, *C. montana*, *C. brevis*, *C. ramosissima*, *C. crispata*, **C. juncea*,
C. mysorensis)
Calyx not 2-lipped or with a slight lower lip, much shorter than the corolla 5
5. Seeds more than 2 per pod, exarillate; small anthers glabrous
..... **C. sect. Crotalaria** (*C. cunninghamii*, *C. novae-hollandiae*, *C. verrucosa*,
C. retusa, *C. quinquefolia*, **C. spectabilis*, **C. lunata*, **C. grahamiana*, **C. distans*,
**C. virgulata*)
Seeds 2 per pod, often arillate; small anthers often spinulose
..... **C. sect. Dispermae** Wight & Arn. (*C. medicaginea*, *C. aridicola*)

Key to Species of *Crotalaria* in Australia

1. Leaves with 3–7 leaflets 2
Leaves simple or unifoliolate 19
2. Leaves with 5–7 leaflets 3
Leaves with 3 leaflets 4

3. Leaflets obovate to oblanceolate, with L:W ratio 2–4:1 ***C. grahamiana** Wight & Arn.
 Leaflets elliptic to linear, with L:W ratio 6–16:1 **C. quinquefolia** L.
4. Corolla 1.7–5.5 cm long; hypanthium prominent, ridged; calyx lobes joined
 at the tips in bud 5
 Corolla 0.5–1.5 cm long; hypanthium not prominent; calyx lobes always free 6
5. Calyx 1.8–3 cm long; pod 7–10 cm long ***C. agatiflora** Schweinf.
 Calyx 0.9–1.7 cm long; pod 2.5–4.5 cm long ***C. laburnifolia** L.
6. Lateral leaflets less than ½ the length of the terminal leaflet **C. eremaea** F.Muell.
 Lateral leaflets more than ½ the length of the terminal leaflet 7
7. Pod 3–7 mm long, seeds 1 or 2; keel beak twisted 8
 Pod more than 7 mm long, seeds more than 2; keel beak straight or twisted 9
8. Corolla 3–8 mm long; pod 3–5.5 mm long, beak 1 mm long **C. medicaginea** Lam.
 Corolla 8–14 mm long; pod 5–7 mm long, beak 1–2 mm long **C. aridicola** Domin
9. Stipules foliaceous, falcate, 5–25 mm long; pod held erect ***C. goreensis** Guill. & Perr.
 Stipules, if present, not foliaceous, linear, subulate or filiform,
 1–12 mm long; pod spreading or deflexed 10
10. Calyx lobes more than twice the length of the tube; corolla scarcely
 exceeding the calyx ***C. incana** L.
 Calyx lobes shorter or slightly longer than the tube; corolla much longer
 than the calyx 11
11. Calyx lobes equal to or longer than the tube 12
 Calyx lobes shorter than the tube 16
12. Calyx 7–13 mm long, wing petals longer than keel;
 bracts 7–13 mm long ***C. micans** Link
 Calyx 2.5–8 mm long, wing petals shorter than or equalling keel;
 bracts 0.7–5 mm long 13
13. Keel beak twisted 14
 Keel beak straight, not twisted 15
14. Corolla 10–15 mm long; pod 1.5–1.9 mm long ***C. distans** Benth.
 Corolla 5–8 mm long; pod 1–1.3 mm long ***C. virgulata** Klotzsh
15. Pod 3–5 cm long; pedicel 3–7 mm long ***C. pallida** Aiton
 Pod 1.1–2.2 cm long; pedicel 1–4 mm long **C. dissitiflora** Benth.
16. Pod 5–7 cm long, 1.5–2 cm wide ***C. ochroleuca** G. Don
 Pod 1–4 cm long, 0.3–0.8 cm wide 17
17. Wing petals longer than the keel; calyx 2–4 mm long ***C. lanceolata** E. Mey.
 Wing petals equal to or shorter than the keel; calyx 3–7 mm long 18
18. Corolla yellow with no other colorations; pod 1.1–2.2 mm long **C. dissitiflora** Benth.
 Corolla veined red-brown, wings with a large purple spot at base;
 pod 2.7–4.5 mm long ***C. zanzibarica** Benth.

19. Stipules decurrent, forming wings on the stem, 3–5 mm wide **C. alata** Buch.-Ham. ex D. Don
 Stipules not decurrent, stem not winged 20
20. Stipules foliaceous, semi-lunate or falcate, 5–35 mm long 21
 Stipules, if present, not foliaceous, ovate, lanceolate, linear or subulate,
 0.5–18 mm long 22
21. Leaf margins undulate; corolla mauve to blue **C. verrucosa** L.
 Leaf margins flat; corolla yellow ***C. lunata** Bedd. ex Polhill
22. Ovary hairy; pod pubescent or glabrescent 23
 Ovary and pod glabrous 28
23. Corolla 24–43 mm long, greenish-yellow **C. cunninghamii** R.Br.
 Corolla less than 20 mm long, yellow, yellow-brown, mauve or blue 24
24. Pod 6–9 mm long, equalling the calyx; plants often viscid; calyx lobe
 margins usually reflexed 25
 Pod 10–40 mm long, much longer than the calyx; plants never viscid;
 calyx lobe margins not reflexed 26
25. Calyx lobes oblong, 1–3.5 mm wide, the margins flat
 or narrowly reflexed, often black **C. ramosissima** Roxb.
 Calyx lobes ovate to orbicular, 3–7.5 mm wide,
 the margins broadly reflexed **C. crispata** F.Muell. ex Benth.
26. Calyx lobes longer than tube; pod velvety hairy ***C. juncea** L.
 Calyx lobes equal to or shorter than tube; pod pubescent or glabrescent 27
27. Keel beak straight or nearly so; bracteoles inserted at base of calyx **C. eremaea** F.Muell.
 Keel beak twisted; bracteoles inserted on the pedicel **C. novae-hollandiae** DC.
28. Leaves unifoliolate (the petiole with a distinct articulation) 29
 Leaves simple (the petiole without an articulation) 30
29. Corolla 5–8 mm long; leaf lamina obovate to broadly elliptic,
 L:W ratio 1–2:1; both surfaces densely hairy **C. smithiana** A.T.Lee
 Corolla 7–18 mm long; leaf lamina variable in shape, L:W ratio
 more than 1.5:1; upper surface either glabrous or pubescent **C. novae-hollandiae** DC.
30. Corolla much longer than the calyx 31
 Corolla equalling the calyx, or slightly longer 33
31. Calyx 4–6 mm long; wing petals equal to or shorter than keel **C. mitchellii** Benth.
 Calyx 8–20 mm long; wing petals longer than keel 32
32. Stipules ovate, 2.5–10 mm long ***C. spectabilis** Roth
 Stipules linear to subulate, 1–2 mm long ***C. retusa** L.
33. Calyx 8–35 mm long, the lobes more than twice the length of the tube 34
 Calyx 4–7 mm long, the lobes slightly longer or shorter than the tube 36
34. Stipules linear-lanceolate, 6–15 mm long **C. mysorensis** Roth
 Stipules minute or absent 35

35. Corolla yellow, 12–18 mm long; calyx 18–35 mm long **C. calycina** Schrank
 Corolla blue, 8–10 mm long; calyx 8–17 mm long **C. sessiliflora** L.
36. Stem prostrate, pilose; leaves ovate, obovate, broad-elliptic or orbicular, L:W ratio 1–2:1.37
 Stem ascending or erect, pubescent; leaves narrowly oblong, narrowly
 elliptic or linear, L:W ratio 2–24:1 38
37. Stipules persistent, 1.5–3.5 mm long; pod 5–9 mm long ... **C. humifusa** Graham ex Benth.
 Stipules minute or absent; pod 9–16 mm long ***C. prostrata** Rottl.
38. Leaves 2–8 cm long, L:W ratio 5–20:1; racemes 10–60 cm long;
 standard 4–7 mm long, emarginate at apex **C. montana** Heyne ex Roth
 Leaves 0.5–3.5 cm long; L:W ratio 2–8:1; racemes 5–13 cm long;
 standard 6–9 mm long, acute or obtuse at apex **C. brevis** Domin

Section A. New records

1. ***Crotalaria prostrata** Rottl. in Willd.,
 Enum. Hort. Berol. 744 (1809). **Type:**
 India, *Rottler* (holo: K, n.v.; photo: BRI).

Prostrate or ascending slender annuals. Stem pilose, hairs to 1.5 mm long. Leaves simple, broadly elliptic, ovate or lanceolate, 5–40 mm long, 3–20 mm wide, L:W ratio 1.5–2:1, apex acute or obtuse, base oblique to subcordate; both surfaces pilose; petiole to 1 mm long; stipules minute or absent. Racemes terminal or leaf-opposed, to 5 cm long; flowers 1–5; bract and bracteoles lanceolate, subulate, 1–2 mm long; bracteoles inserted just below calyx; pedicel 1.5–3.5 mm long. Calyx 4–6.5 mm long, 2-lipped, pilose; lobes longer than tube. Corolla slightly longer than calyx; standard obovate, emarginate, 4–7 mm long, glabrous, yellow; wings oblong, shorter than keel; keel 5–7 mm long, beak slightly twisted. Pod sessile, oblong-ellipsoid, 9–16 mm long, 4–6 mm wide, glabrous; seeds 12–20. Seed 1.6–2.2 mm long, brown. Fig. 1A–E.

Specimens examined: **Western Australia.** Old Presbyterian mission of old Kunmunya, Apr 1992, *Mitchell* 2347 & *Willing* (PERTH). **Northern Territory.** Tin Camp Creek, c. 2 km SW Myra Falls, Apr 1993, *Brennan* 9656 (DNA); Gove, mine area, Jul 1971, *Byrnes* 2349 (CANB, DNA).

Distribution: Recorded in only a few places at Gove and Tin Camp Creek in the N.T., and at Kunmunya in W.A. Native of India and S.E. Asia.

Phenology: Flowers April to November, possibly at other times.

Discussion: This species is most closely related to *C. humifusa* and *C. acicularis*, but differs from those species in the much longer pod and minute or absent stipules.

Section B. Clarification of names

2. **Crotalaria humifusa** Graham ex Benth.,
 Lond. J. Bot. 2: 476 (1843). **Type:**
 Himalaya, Nepal; *Wallich* 5421 (syn: K,
 n.v.; photos: BRI).

C. acicularis auct. non Buch.-Ham. ex
 Benth.: Stanley & Ross (1883, 1: 274);
 Hacker (1990: 110).

Illustration: Wheeler *et al.* (eds) (1992:
 383, fig. 113f).

Prostrate annuals. Stem pilose, hairs 1–5 mm long. Leaves simple, suborbicular, broad-elliptic or broad-obovate, 6–25 mm long, 5–20 mm wide, apex rounded; both surfaces moderately pilose; petiole 1–2 mm long; stipules linear-lanceolate, 1–3.5 mm long. Racemes terminal or leaf-opposed, to 7 cm long; flowers 1–5; bract and bracteoles lanceolate, 1–3.5 mm long, inserted just below calyx; pedicel 2–3.5 mm long. Calyx 4–6 mm long, 2-lipped, villous; lobes longer than tube, upper 2 joined higher than lower 3. Corolla ± equalling the calyx; standard obovate to suborbicular, apex rounded or emarginate, 4–5 mm long, yellow, glabrous; wings c. 3 mm long, shorter than keel; keel 3.5–4.5 mm long, beak twisted. Pod sessile, oblong-ellipsoid, 5–9 mm long, 2–4 mm wide, glabrous; seeds 6–8. Seed 1–1.2 mm long, brown or green.

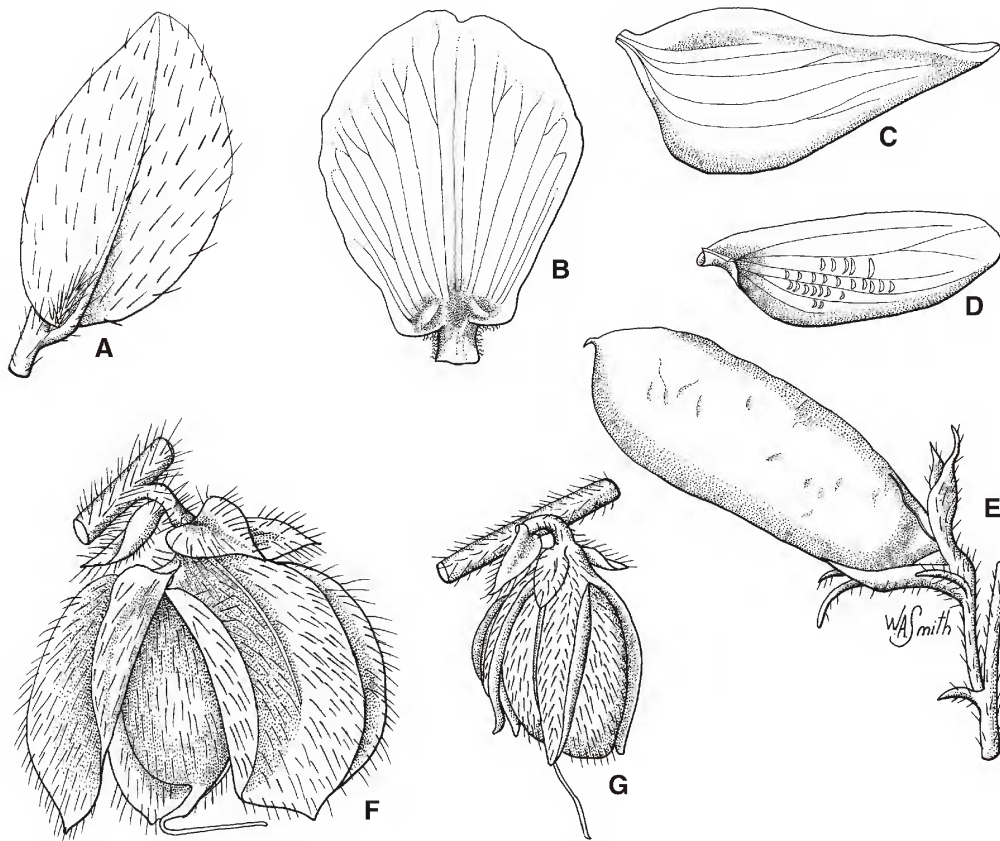


Fig. 1. A–E: *Crotalaria prostrata*. A. leaf $\times 2$. B. standard petal $\times 8$. C. keel petal $\times 8$. wing petal $\times 8$. E. pod $\times 4$. F. *Crotalaria crispata*, pod $\times 4$. G. *Crotalaria ramosissima*, pod $\times 4$. A–E: Byrnes 2349 (DNA). F: Leach 4484 (BRI). G: Cumming 17619 (BRI).

Specimens examined: Western Australia. Northern end of Airfield Swamp, Mitchell Plateau, Jun 1976, *Kenneally* 4862 (PERTH); 7 km NE of Beverley Springs Homestead, May 1979, *Muir* 644 (PERTH); Mertens Creek Falls tourist campsite, c. 15 km W of Mitchell Plateau, May 1988, *Pullen* 11.217 (CANB, PERTH); Koongarra, May 1981, *Rice* 4009 (CANB); Upper Camp Creek, E of Mitchell Plateau Airstrip, May 1991, *Willing* 433 (PERTH). **Northern Territory.** Canburra Creek, Elcho Island, Jul 1975, *Latz* 6256 (AD, BRI, CANB, DNA, PERTH). **Queensland.** COOK DISTRICT: Thursday Island, 1885, *Bauerlen s.n.* (BRI); Atherton, Aug 1901, *Betche s.n.* (NSW); Chester River, McIlwraith Ra., Jul 1978, *Clarkson* 2400 (BRI); Kilber Paddock, 5 km E of Gulf of Carpentaria, Edward R., Apr 1980, *Garnett* Y5 (BRI). NORTH KENNEDY DISTRICT: Near Porters Creek, 27 km N of Ingham, Jun 1991, *Bean* 3261 (BRI, MEL); Mount Fox, Sep 1949, *Clemens s.n.* (BRI). SOUTH KENNEDY: Dalrymple Heights and vicinity, Jul 1947, *Clemens s.n.* (BRI). MORETON DISTRICT: Logan River, undated, *Scortechini s.n.* (BRI, MEL); Enoggera, undated, *Bailey s.n.* (NSW); D'Aguilar, Mar 1934, *Newman s.n.* (BRI).

Distribution and Habitat: Scattered in coastal areas across northern Australia, from the

Kimberley region in W.A., through the northern part of the N.T. and along the entire east coast of Qld. Also in Asia. It occurs in *Eucalyptus* woodland, on creek beds and alluvial flats, in sandy, seasonally damp soil.

Phenology: Flowers March to October.

Discussion: *Crotalaria humifusa* and *Crotalaria acicularis* Buch.-Ham. ex Benth. are very similar and the names have been variously applied in the Australian literature. Descriptions and differences are given by de Munk (1962), Niyomdham (1978) and Verdcourt (1979). In summary, *Crotalaria humifusa* has filiform to lanceolate bracts, 1–3.5 mm long, not cordate at the base, *Crotalaria acicularis* has ovate bracts, 3–6 mm long, cordate at the base.

I have identified all of the Australian material as *C. humifusa*. *C. acicularis* is occasionally cultivated but not known to be naturalised.

3. *Crotalaria mysorensis* Roth, Nov. Pl. Sp. 338 (1821). Type: East India, Mysore, Heyne (syn: K n.v. [photos at BRI]).

Crotalaria membranacea W.Fitzg., J. Proc. Roy. Soc. Western Australia. Type: Western Australia. Base of Inglis' Gap, King Leopold Range, May 1905, Fitzgerald 781 (holo: PERTH; iso: NSW; photos: BRI).

Illustrations: Wheeler *et al.* (eds) (1992: 384, fig. 114d.) as *C. membranacea*.

Perennial herbs or subshrubs to 1.5 m high. Stem pilose, hairs 4–5 mm long, brown. Leaves simple, narrowly elliptic, oblong or obovate, 1–8 cm long, 2–17 mm wide, apex acute or rounded; both surfaces pilose; petiole to 3 mm long; stipules lanceolate, 6–15 mm long, sometimes caducous. Racemes terminal or axillary, to 24 cm long; flowers 1–7; bract linear-lanceolate, shortly stipitate, 12–23 mm long; bracteoles 6–14 mm long, inserted at base of calyx; pedicel 2–10 mm long. Calyx 13–17 mm long, 2-lipped, densely pilose; lobes much longer than tube. Corolla scarcely exceeding calyx; standard oblong, ovate or elliptic, acute or obtuse, 13–18 mm long, pale yellow; outer surface pubescent; wings 8–10 mm long, shorter than or equalling keel; keel 10–14 mm long, beak slightly twisted. Pod sessile, obovoid, 18–35 mm long, 11–18 mm wide, glabrous; seeds 15–60. Seed 2.8–3.3 mm long, brown.

Selected specimens: Western Australia. Kalumburu road, 227.8 km by road N of Junction with Gibb River and Ellenbrae road, Apr 1988, *Aplin* 839 (CANB, PERTH); Mining Plant area, Mitchell Plateau, Aug 1978, *Beaglehole* 58970 (PERTH); Mount House, Apr 1960, *Blythe s.n.* (PERTH); 72 km S of Kalumburu, May 1971, *Byrnes* 2293 (DNA, PERTH); 40 km S of Kalumburu, May 1993, *Cowie* 4289 (PERTH); Barker River just N of Mount Hart Homestead, King Leopold Ranges, Jun 1988, *Edinger* 615 (PERTH); Gandjal Creek, Prince Regent River, Aug 1974, *George* 12371 (PERTH); Walsh Point, Warrender, Apr 1982, *Keighery* 4736 (PERTH); Camp Creek South, Mitchell Plateau, Jun 1976, *Kenneally* 5163 (PERTH); Crusher Vine Thicket, Mitchell Plateau, Jun 1976, *Kenneally* 5334 (PERTH); Kimbolton Station, May 1993, *Mitchell* 3095 (PERTH); Derby, Aug. 1970, *Payne s.n.* (PERTH); King

Leopold Ranges; upper March Fly Glenn, c. 1.5 km S of Gibb River road, Jun 1988, *Sands* 4912 (PERTH); Stewart River 12 km N of Kimbolton Homestead, Jul 1977, *Telford* 6336 (PERTH).

Distribution and Habitat: Occurs in the Kimberley region of W.A., from Kalumburu to Derby, in open *Eucalyptus* woodland and grassland, often on creek banks, mostly in clay soils. Also in India.

Phenology: Flowers February to June.

Discussion: Syntypes of *Crotalaria mysorensis* from India (Heyne), were examined and compared with the type material of *C. membranacea* from W.A. The material is similar except that the type material of *C. mysorensis* has 4–6 flowered racemes, whereas the type material of *C. membranacea* has 2–4 flowered racemes. However, the remaining Australian material has racemes varying from 2 to 7 flowers and is otherwise indistinguishable from the type material of *C. mysorensis*. *Crotalaria membranacea* is therefore here considered to be a synonym of *C. mysorensis*.

Roth (1821) describes 2 varieties of *C. mysorensis*: **a.** var. *pauciflora*, which has thin stem and leaves rarely covered with hairs, and short few-flowered racemes; **b.** var. *angustifolia*, which has narrow leaves totally covered with hairs. Australian material exhibits a continuum of variation in leaf size, shape and hairiness, the lower leaves elliptic to oblong and the upper leaves smaller, narrower and more densely hairy. Therefore no varieties are recognised here.

4. *Crotalaria crispata* F.Muell. ex Benth., Fl. Austral. 2: 179 (1864). Type: Northern Territory. Gravelly river bank, and plains and stony ridges on the Victoria River and its lower tributaries, Oct 1855–May 1856, *Mueller s.n.* (lecto, here designated: MEL [MEL 47637] upper right hand specimen [photo at BRI]).

Crotalaria sp. A. in Wheeler *et al.* (eds) (1992)

Illustrations: Wheeler *et al.* (1992: 389, fig. 116e) as *Crotalaria* sp. "A".

Annual or perennial herbs to 50 cm tall. Stem, villous or sericeous, rarely subglabrous, hairs *c.* 1 mm long. Leaves simple, obovate or oblong, 7–40 mm long, 4–11 mm wide, apex rounded or emarginate, both surfaces hairy; petiole to 2 mm long; stipules linear, to 2 mm long, or absent. Racemes terminal, to 8 cm long; flowers 2–7; bract and bracteoles ovate, 2–4 mm long; bracteoles inserted just below calyx; pedicel 1.5–3 mm long. Calyx 6–11 mm long, 2-lipped; lobes ovate to suborbicular, acute or rounded, more than twice the length of the tube, 3–7.5 mm wide (including reflexed portion), the margins broadly reflexed, reflexed portion 1–2.5 mm wide; inner surface glabrous or slightly hairy, viscid. Corolla equal to or shorter than calyx; standard ovate, obovate, or elliptic, apex acute, 6–9 mm long, yellow, veins reddish-brown; wings oblong, 5–7 mm long, shorter than keel; keel 6–8 mm long, beak slightly twisted. Pod sessile, oblong-ellipsoid, 6–9 mm long, 3–5 mm wide, densely villous; seed 1. Seed 3.5–5 mm long, black or brown. Fig. 1F.

Selected specimens: **Western Australia.** *c.* 200 km N of Halls Creek on road to Kununurra, Apr 1985, *Aplin* 1364, *Cranfield & Wheeler* (CANB, PERTH); Martins Gap, E of Ord River, Kimberley, Apr 1956, *Burbidge* 5158 (CANB, PERTH); NW of Deception Range, Mar 1978, *Hartley* 14783 (CANB, PERTH); 5 km SSE of Kununurra, Mar 1978, *Pajjmans* 2323 (CANB, DNA, PERTH); 27 miles [43 km] NNE of Denham River Station, Jul 1949, *Perry* 2538 (BRI, CANB); 5 miles [8 km] E of Kimberley Research Station, Jul 1949, *Perry* 2564 (BRI, CANB, DNA, MEL); Smoke Creek, SW of Lake Argyle, Apr 1980, *Weston* 12084 (CANB, PERTH). **Northern Territory.** Katherine, Apr 1947, *Blake* 17410 (BRI, CANB, MEL); 12 miles [19 km] E of Old Crossing, Victoria River, May 1968, *Byrnes* NB726 (AD, BRI, DNA, PERTH); Edith River, Mar 1961, *Chippendale* NT7543 (DNA, CANB); 26.2 miles [41.9 km] SW of Willeroo Homestead, May 1960, *Chippendale* NT6848 (BRI, CANB, DNA, PERTH); Katherine Gorge N.P., Apr 1981, *Craven* 14205 (BRI, DNA, CANB, MEL); Keep River N.P., Apr 1990, *Evans* 3162 (CANB, DNA); 60 km NE of Maraboy Police Station, Mar 1965, *Lazarides* 54 & *Adams* (CANB, DNA); Yambarran Range, 19 km NE of Mount Millikmonmir, May 1994, *Leach* 4484 & *Walsh* (BRI, MEL); Flying Fox Creek between Beswick and Mainoru Stations, May 1974, *Pullen* 9350 (DNA, CANB, NSW). **Queensland.** BURKE DISTRICT: Between Gilbert Telegraph Station & crossing of Gibert River Lagoons, *Armit* 598 (MEL); Near Saxby River, 1883, *Palmer s.n.* (MEL); On track *c.* 1.5 km N of Carron River, *c.* 41 km NE Croydon (site 14), May 2001, *Turpin* GPT57 & *Thompson* (BRI).

Distribution and habitat: Northern Australia from the King Leopold Range in north-western W.A., across the N.T., and as far east as

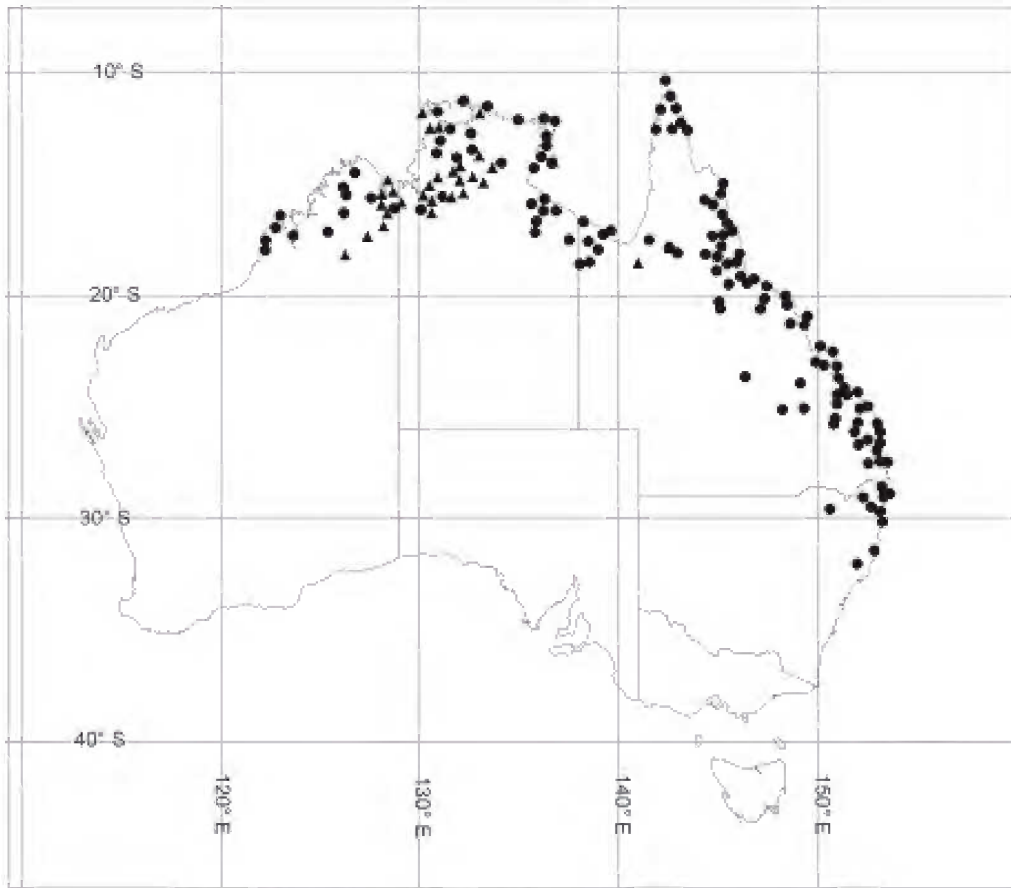
Croydon in northern Qld. Occurs in open woodland and grassland, often near rivers or swamps, in loamy or sandy soil. Map 1.

Phenology: Flowers February to October.

Discussion: *Crotalaria crispata* and *Crotalaria ramosissima* Roxb. (see below) have been confused in the Australian literature and the circumscription and lectotypification of *C. crispata* is therefore necessary. *Crotalaria crispata* is most easily distinguished from the widespread *C. ramosissima* by the width of the calyx lobes (including reflexed portion): *C. crispata* has calyx lobes 3–7.5 mm wide and *C. ramosissima* has calyx lobes 1–3.5 mm wide. These two species are very closely related but there are no intermediate forms in the Australian material. *C. crispata* appears to be endemic.

Lectotypification: The collections cited by Bentham are: **a.** Islands of the Gulf of Carpentaria, *R. Brown s.n.* (BM); **b.** Victoria, Fitzmaurice and Baines Rivers, Oct 1855–May 1856, *F. Muell.* (MEL[MEL 47637]). The label on the MEL sheet has the name *C. crispata* written under the name *C. ramosissima* Roxb. followed by “Gravelly river bank, and plains and stony ridges on the Victoria River and its lower tributaries”. Of the three specimens on this sheet, the upper two have broad calyx lobes (*C. cristata*) and the lower one has narrow calyx lobes (*C. ramosissima*). The Brown specimen (BM) from the Gulf of Carpentaria also has narrow calyx lobes. Bentham appears to have included both taxa (broad and narrow calyx lobes) in his description, but states that *C. crispata* resembles *C. ramosissima* “in many respects, but which, in its large flowers and broad, reflexed viscous bracts [calyx lobes?], is nearer to *C. lunulata* Heyne.” *C. lunulata*, however, differs markedly from both species in the calyx which is much shorter than the corolla, and the pod which is *c.* 15 mm long.

The upper right hand specimen on the MEL sheet [MEL 47637] is therefore here chosen as the lectotype for the name *C. crispata*. The upper left hand specimen represents the more densely hairy form of this species. The lower specimen on this sheet and the Brown specimen (BM) are correctly



Map 1. Distribution of *Crotalaria brevis* ● and *Crotalaria crispata* ▲.

identified as *C. ramosissima*.

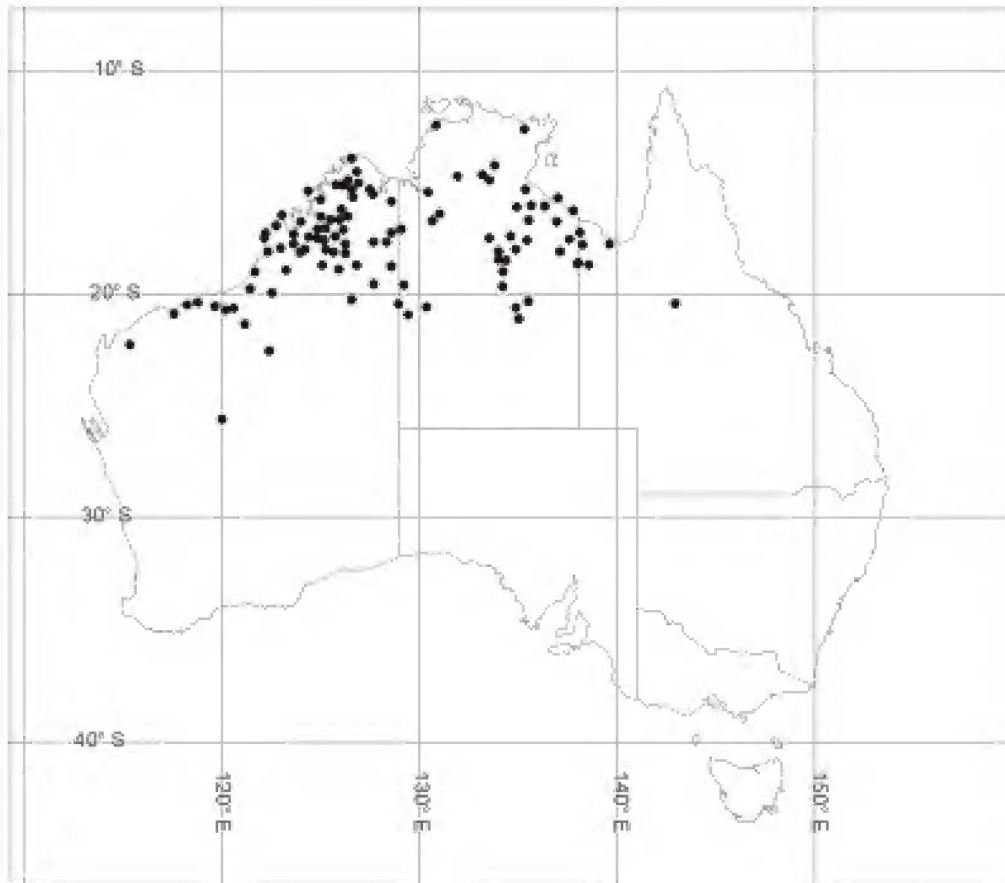
5. *Crotalaria ramosissima* Roxb., Fl. Indica (Carey) 2nd edn. 3: 268 (1832). **Type:** India. "Native to the interior parts of Bengal", Wallich 5380 (holo: K, n.v.; photo: BRI).

Illustration: Wheeler *et al.* (eds) (1992: 383, fig. 113c) as *C. crispata*.

Annual or perennial herbs to 70 cm tall; stem villous or nearly glabrous; hairs *c.* 1 mm long. Leaves simple, obovate or oblong, 5–28 mm long, 2–9 mm wide, apex rounded; both surfaces villous; petiole to 2 mm long; stipules minute or absent. Racemes terminal, to 12 cm long; flowers 4–21; bract and bracteoles ovate, 2–6 mm long; bracteoles inserted just below calyx; pedicel 1–3.5 mm long. Calyx 7–11 mm

long, 2-lipped; lobes oblong, more than twice the length of the tube, 1–3.5 mm wide (including the reflexed portion), the margins slightly recurved to reflexed, reflexed portion *c.* 1 mm wide; inner surface often black, viscid. Corolla equal to or shorter than calyx; standard obovate or elliptic, apex acute, 5–9 mm long, 3–5 mm wide, yellow, veins reddish-brown; wings oblong, 4–7 mm long, shorter than keel; keel 5–8 mm long, beak slightly twisted. Pod sessile, oblong-ellipsoid, 6–9 mm long, 3–5 mm wide, villous; seed 1. Seed 3–4 mm long, brown. Fig. 1G.

Selected specimens: Western Australia. 25 km W of Petermarer Creek crossing by NW coastal Hwy, *c.* 14 km by road ENE of main Port Hedland-Wittenoom road, Aug 1978, Barker 2787 (AD, MEL); Cape Leveque, Apr 1988, Dunlop 7821 (DNA, MEL, PERTH); Red Dune, near Edgar Range, SE of Broome, Aug 1976, Kenneally 5549 (CANB, PERTH); 75 km W of Wyndham, *c.* 7 km SSW of Paradise



Map 2. Distribution of *Crotalaria ramosissima*.

Pool on Ernest River, NE Kimberley, Mar 1978, *Lazarides* 8647 (CANB, DNA, PERTH); Hann River, 48 miles [77 km] W of Tableland Station, Oct 1959, *Lazarides* 6434 (BRI, CANB, DNA, PERTH); Bungle Bungle N.P., 7 km NNW of Goose Hole Yard, Ord River, Jun 1989, *Menkhorst* 435 (PERTH, DNA); 6 miles [10 km] W Bloodwood Bore, Balweena Reserve, Aug 1969, *Nelson* 1934 (DNA, MEL, PERTH); 4 km SW of Shay Gap (town), c. 160 km E of Port Hedland, Jul 1984, *Newbey* 10281 (CANB, PERTH). **Northern Territory.** South bank of Katherine River near junction with Limestone Creek, Oct 1946, *Blake* 17222 (BRI, CANB, DNA); Burrabellly Waterhole, Frew River, Feb 1972, *Dunlop* 2497 (BRI, CANB); Ryans Bend Waterhole, Jun 1971, *Henry* 40 (BRI, CANB, MEL); 15 miles [24 km] SW of Inningarra Range, Aug 1970, *Maconochie* 945 (AD, BRI, DNA); 39 miles [62 km] E of Beswick, Jun 1972, *Maconochie* 1425 (BRI, CANB, DNA); Elkedra Station Creek crossing 14 km NW of Homestead on Hatches Creek road via jump-up, Aug 1979, *Morton* 235 (DNA, MEL); 10 miles [16 km] NNE of Borroloola, Jul 1948, *Perry* 1783 (AD, BRI, CANB, DNA, MEL); Arnhem land, Yirimal, Aug 1986, *Scarlett* 232 & *White* (CANB, DNA). **Queensland.** BURKE DISTRICT: Nicholson River, May 1940, *Jensen s.n.* (BRI); Richmond, Westmoreland, Lagoon Creek, off track

to Camp Ridgeway, May 1997, *Forster* PIF21008 & *Booth* (BRI, MEL).

Distribution and habitat. Northern Australia, from Port Hedland in W.A., through the northern part of the N.T. and in north-western Qld as far east as Richmond. Occurs in open woodland, open shrubland and grassland, usually near creeks and rivers, in sandy soil. Also in India and SE Asia. Map 2.

Phenology. Flowers most of the year, more commonly in the winter months.

6. *Crotalaria brevis* Domin, Biblioth. Bot. 89 (2): 126 (1925). Type: North Coast, 1802-3, *R. Brown* 5092, (lecto, here designated: K specimen on upper half of sheet: photo: BRI).

Crotalaria sp. B in Wheeler *et al.* (eds) (1992)

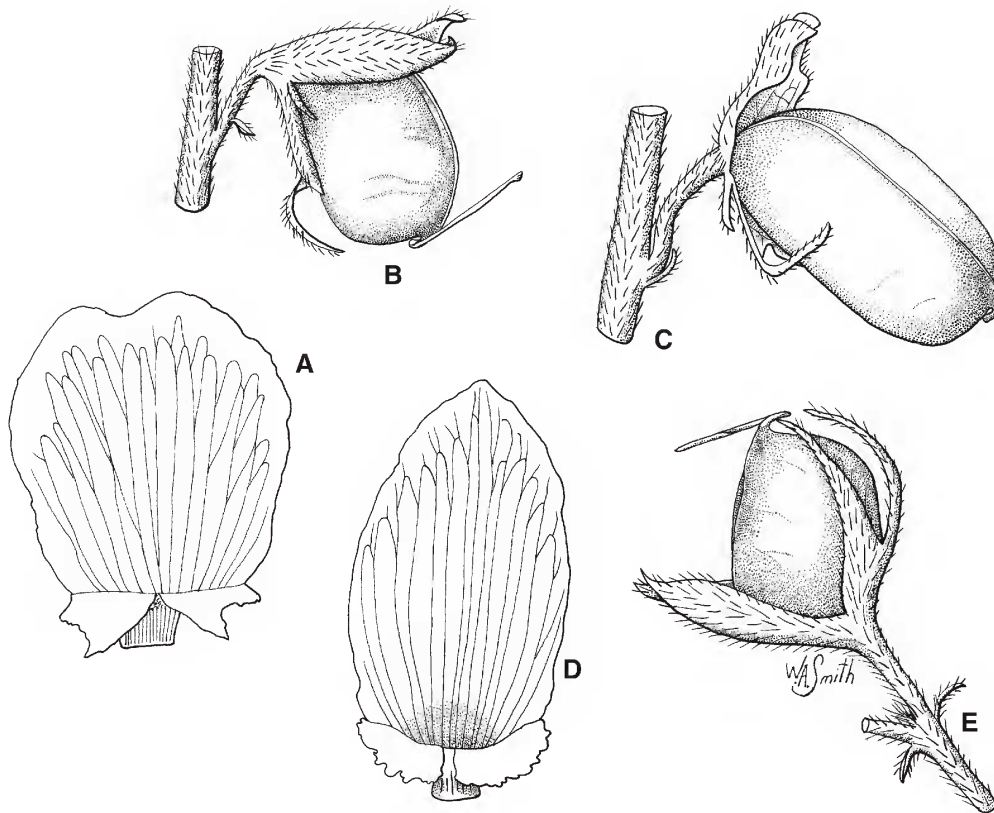


Fig. 2. A, B: *Crotalaria montana* var. *angustifolia*. A. standard petal $\times 8$. B. pod $\times 4$. C. *montana* var. *exserta*. C. pod $\times 4$. D, E: *C. brevis*. D. standard petal $\times 8$. E. pod $\times 8$. A, B: Bean 11381 (BRI). C: Forster PIF 22182 (BRI). D, E: Leach 2927 & Cowie (BRI).

Illustrations: Wheeler *et al.* (1992: 389, fig. 116f) as *Crotalaria* sp. "B".

Erect, ascending or decumbent annual or perennial herbs. Stem several to many, to 40 cm long, moderately to densely pubescent, rarely glabrous; hairs spreading or appressed. Leaves simple, elliptic to obovate, or oblong; 6–35 mm long, 1–10 mm wide, L:W ratio 2–10:1, apex acute or obtuse; upper surface nearly glabrous or both surfaces pubescent, hairs appressed or spreading, to 1.5 mm long; petiole to 2 mm long; stipules absent. Racemes 0.5–13 cm long; flowers 1–10; bract and bracteoles linear, 1–4 mm long; bracteoles inserted on the calyx; pedicel 2–6 mm long. Calyx 6–9 mm long, pubescent; upper 2 lobes joined nearly to the apex; lower lobes longer than tube. Corolla equalling calyx or slightly longer; standard elliptic, ovate, obovate or oblong, acute or obtuse, auriculate, 6–9 mm long, 3–5 mm wide,

yellow, veins reddish; wings oblong to obovate, shorter than keel; keel 6–9 mm long, beak twisted. Pod sessile, oblong-ellipsoid, 5–11 mm long, 3.5–6 mm wide, glabrous; seeds 8–14. Seed 1.5–2.5 mm long, brown or olive. Fig. 2 D–E.

Selected specimens: **Western Australia.** Where Balk Creek south crosses main road, Apr 1992, *Carter* 520 (DNA, PERTH); 73 km W of Wyndham, 13 km S of Paradise Pool, Mar 1978, *Lazarides* 8645 (DNA, PERTH); King Edward River, Jun 1987, *Keighery* 9005 (PERTH); roadside near Cable Beach, Jan 1992, *Mitchell* 1948 (DNA, PERTH); Mangel Creek Station, S of the Derby to Broom road, Apr 1968, *Payne s.n.* (PERTH); Kununurra, Lake Argle road, 60 km from Kununurra, Apr 1977, *Pullen* 10.688 (CANB, PERTH). **Northern Territory.** Giddy River crossing, Jun 1972, *Byrnes* 2594 (CANB, DNA); 4.3 miles [6.9 km] NW of Pine Creek, Mar 1961, *Chippendale* NT7609 (AD, BRI, CANB, DNA, PERTH); Kapalga, Feb 1977, *Collins* 226 (CANB, DNA); Berrimah, May 1989, *Cowie* 744 (DNA, MEL); Groote Eylandt, 7 km SSE of Alyangula, Apr 1992, *Cowie* 2541 (DNA, MEL); 8 miles [13 km] NE of El Sharana Mine, Feb 1973, *Lazarides* 7869 (CANB, DNA); Bessie

Springs, McArthur River Station, Jun 1977, *Must* 1537 (DNA, CANB); 50 miles [80 km] E of Borooloola Station, Aug 1964, *Perry* 1835 (DNA); 12 miles [19 km] NE of Katherine, Jan 1965, *Wilson* 83 (BRI, CANB, DNA). **Queensland.** BURKE DISTRICT: Lawn Hill N.P., Apr 1997, *Forster* PIF 20880 & *Holland* (BRI); 46 km NW of old Corinda outstation, May 1974, *Pullen* 9164 (BRI, CANB). COOK DISTRICT: Newcastle Bay, May 1948, *Brass* 18748 (CANB); Mount Molloy, Apr 1962, *McKee* 9109 (BRI). NORTH KENNEDY DISTRICT: Clarke River, Jan 1982, *Pedley* 4824 (BRI, MEL). SOUTH KENNEDY DISTRICT: Shoal Point, Mackay, Feb 1993, *Batianoff* 9302402 (BRI). LEICHHARDT DISTRICT: Blackdown Tableland, c. 3–5 km W of Mimosa Creek campsite, 32 km SE of Blackwater, Apr 1971, *Henderson* 749 (BRI, MEL). PORT CURTIS DISTRICT: Cannona, 40 km N of Rockhampton, Jun 1996, *Anderson* 4992 (BRI). MARANOVA DISTRICT: 1.5 km SE of Mount Moffatt Homestead, Mount Moffatt N.P., Jan 1998, *Bean* 12960 (BRI). WIDE BAY DISTRICT: Welcome Creek, c. 5 km from Moore Park N of Bundaberg, Nov 1978, *Stanley* 78134 (BRI). MORETON DISTRICT: North Stradbroke Island, Point Lookout, Aug 1969, *Coveny* 1971 (BRI, NSW). **New South Wales.** Lower Slopes of Gloucester Buckets at N end, c. 2 km W of Gloucester, Jan 1994, *Coveny* 16737 (BRI, NSW).

Distribution and habitat: Northern and eastern Australia, from Roebuck Bay in W.A., across the N.T., and along the east coast of Australia as far south as Gloucester in N.S.W. Occurs in *Eucalyptus* woodlands and forests, in a variety of soils. Map 1.

Phenology: Flowers December to August.

Discussion: *C. brevis* is easily distinguished from *C. montana* by the shorter racemes, fewer flowers and the standard petal which is ovate to elliptic, 3–5 mm wide and acute or obtuse at apex. The length, direction and density of hairs varies from moderate to dense, spreading or appressed, 1–3 mm long. A few specimens from Western Australia have smaller pods 5–7 mm long and 3.5–4 mm wide (species “B” in Wheeler *et al.* (1992)): Flats between Bell Creek and the King Leopold Range, May 1988, *Goble-Garratt* 667 (PERTH); Mount Elizabeth Station, NE of Derby & SW of Wyndham, May 1968, *Hutchinson* 2 (PERTH).

Crotalaria brevis, *C. nana* Burm. and *C. melanocarpa* Wall. ex Benth. are closely related species, probably part of a complex extending from India to Australia. According to Domin (1925), *C. nana* differs from *C. brevis* in the “smaller flowers in heads and smaller fruits”. Niyomdham (1978) and Rudd (1991) describe *C. nana* as having flowers and pods c. 5 mm long, smaller than those of any Australian material. I therefore conclude that

C. nana s.s., does not occur in Australia.

According to Niyomdham (1978), *C. melanocarpa* has an erect habit (to 50 cm tall), leaves 20–40 mm long, standard petal acute, 5.5 mm × 4 mm, and pods 7 mm × 4 mm. A few eastern Queensland specimens are similar to the type material of *C. melanocarpa*: Castle Hill, Townsville, *Bean* 4074 (BRI); Herberton, 1.5 km W on Petford Rd, *Conn* 1132 & *Clarkson* (BRI). However, these character states do not clearly separate these specimens from the remaining specimens identified as *C. brevis*.

At the present time, the name *C. brevis* is retained for Australian material. This taxon is considered to be endemic and is distinguished from *C. melanocarpa* by the larger flowers and pods. However, several forms are represented in the type material, and circumscription and lectotypification is therefore necessary. Examination of the full extent of the variation present in non-Australian material will be needed in order to clearly define all of the taxa and correctly apply names.

Lectotypification: Eight collections are cited by Domin: **a.** North Coast, *R. Brown* 5092, (K, upper half of sheet); **b.** McAdam Range, *F. Mueller* (K, lower half of same sheet as a.); **c.** Yarraba, Jan–Feb 1910, *K. Domin* (PR [PR527119]); **d.** Atherton, Jan–Feb 1910, *K. Domin* (PR [PR527120]); **e.** Mareeba, Jan–Feb 1910, *K. Domin*, (PR [PR527118]), (c., d. and e. are on the same sheet); **f.** Pentland (2 sheets), Mar 1910, *K. Domin* (PR [PR527123]) and *K. Domin* (PR [PR527117]); **g.** Cape York, Nov 1849, *J. MacGillivray* 14 XI (not seen); **h.** Voyage of Rattlesnake, Botany No. 525, *A. Dietrich* 2456 (PR [PR527121], BRI, CANB); **i.** *R. Brown* 5091, Iter Australiense 1802–05 (not seen). Specimen **a.** is here chosen as lectotype. This specimen closely agrees with Domin’s description, and represents a form that is common across northern Australia.

Section C. New combinations

7. *Crotalaria cunninghamii* R.Br., in Sturt, C., Narr. Exped. C. Australia, Bot. App. 71 (1849). **Type:** barren shores of Goodenough Bay, SE of Cygnet Bay, NW

Coast, 1818, *A. Cunningham* (lecto, here designated: K (lower right hand specimen); photo: BRI).

Shrub to 4 m high. Stem stout, softly woody, velvety tomentose. Leaves unifoliolate, rarely trifoliolate; lamina broadly elliptic, ovate or suborbicular, 2–13 cm long, 1–8 cm wide, apex obtuse or retuse; both surfaces tomentose; petiole 0.5–4.5 cm long; stipules subulate, 2–18 mm long. Racemes terminal or axillary, to 35 cm long; flowers 1–52; bract ovate–

lanceolate, 5–17 mm long; bracteoles 1–14 mm long, inserted on the pedicel; pedicel 5–30 mm long. Calyx 11–30 mm long, velvety, lobes equal to or longer than tube. Standard ovate, apex acute, 20–43 mm long, greenish yellow, veins purple; wings ovate or elliptic, shorter than keel; keel 35–60 mm long, beak twisted. Pod stipitate, oblong-clavate, 3–6 cm long, 1–1.5 cm wide, velvety tomentose; seeds 3–16. Seed 4–7 mm long, brown.

Two subspecies are recognised here.

Key to subspecies of *Crotalaria cunninghamii*

Petiole to 2.5 cm long; racemes 0.1–3.5 cm long; flowers 1–19 **7a.** subsp. **cunninghamii**
 Petiole to 4.5 cm long; racemes 5–35 cm long; flowers 20–52 **7b.** subsp. **sturtii**

7a. *Crotalaria cunninghamii* R.Br. subsp. *cunninghamii*

Illustrations: Hooker (1852: plate 829); Jessop (ed.) (1981: 154, fig. 176); Wheeler *et al.* (eds) (1992: 381, fig. 112).

Leaves always unifoliolate; petiole to 2.5 cm long. Racemes often appearing to be axillary, 0.1–3.5 cm long; flowers 1–19. Calyx lobes slightly longer than the tube to more than twice the length of the tube. Keel petal 37–60 mm long.

Selected specimens: Western Australia. Broome, new jetty area, Aug 1965, *Beaglehole* 11251 (MEL, PERTH); Stewart River near Oobagooma road N of junction of Robinson Rivers, 74 km NNE of Derby, Jun 1976, *Beaglehole* 52879 (PERTH); Between Kimberley Research Station and Martins Gap, Apr 1956, *Burbridge* 5125 (BRI, CANB, MEL, PERTH); Dampier district, Cape Kerauderen, Aug 1974, *Carr* 4518 (PERTH); Great Sandy Desert, May 1984, *Fatchen* 872 (AD); 4 km S of Cape Bertholet, Dampierland N of Broome, Apr 1977, *Kenneally* 6050 (PERTH); Kunnunurra township, Jun 1975, *Symon* 10326 (AD, CANB, PERTH). Northern Territory. Gardiner Range, far West Tanami, Jun 1996, *Albrecht* 7793 (DNA); 32 km W of Muchaty Homestead, Apr 1974, *Hagan s.n.* (DNA); 11 km SW of Sangsters Bore, Tanami Desert, Jun 1991, *Latz* 11969 (DNA); Lake Mackay on Island in SE area of lake, Oct 1992, *Latz* 13016 (DNA); Mount Young, Nathan River Stn, Nov 1987, *Russell-Smith* 6725 (BRI, DNA); 17 km E of Calvert River mouth, Jun 1987, *Thomson* 1799 (DNA); Newcastle Waters, Jul 1958, *Trapnell* 63 (BRI); Kalkaringi area, Leichhardt Springs, Aug 1993, *Whiteman* 6209 (DNA).

Distribution and habitat: North-western W.A. from Broome to the Ashburton River and in the northern half of the N.T. as far east as the

Calvert River. Occurs on sand dunes, coastal dunes, and in grassland or grassy woodland, on sandy soil. Map 3.

Phenology: Flowers mainly from May to October.

7b. *Crotalaria cunninghamii* subsp. *sturtii* (R.Br.) A.E.Holland, comb. nov.

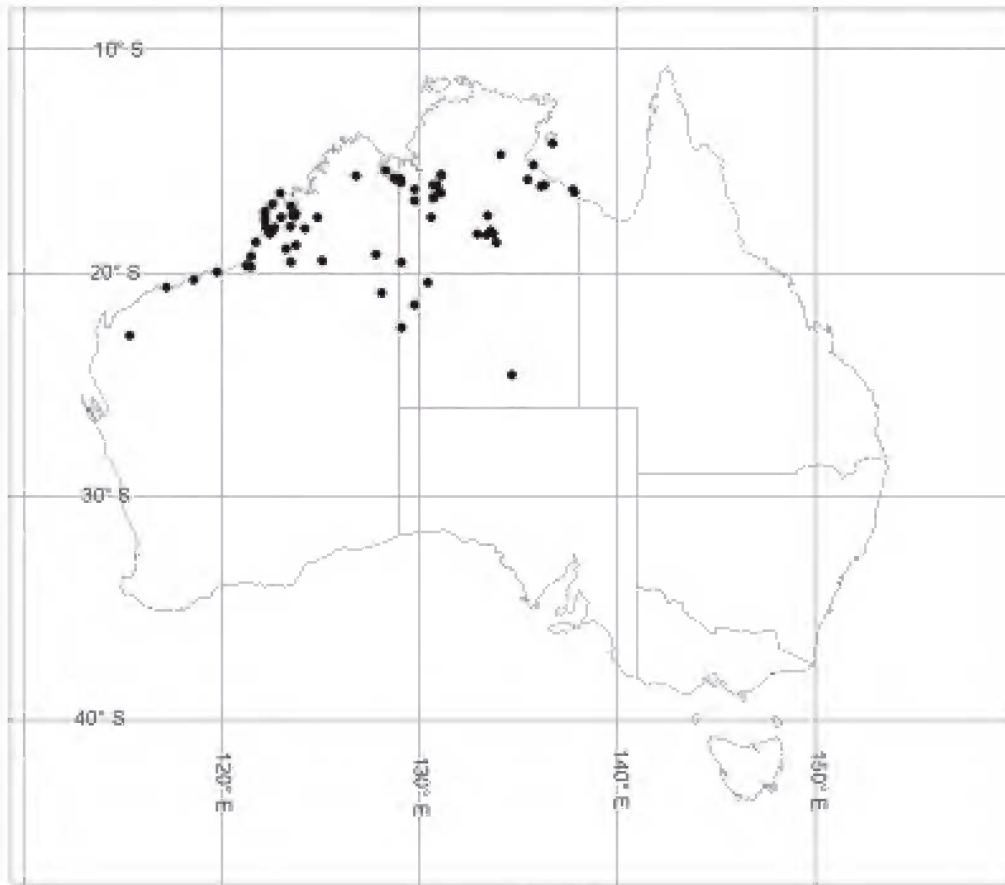
Crotalaria sturtii R.Br., in C. Sturt, Narr. Exped. C. Australia. Bot. App. 70. (1849) **Type:** On top of the ridges of pure sand, from S. lat. 28° to 26°, *C. Sturt s.n.* (holo: BM n.v. photo: BRI).

Crotalaria cunninghamii var. *trifoliolata* J.Black, Trans. R. Soc. S. Aust. 41: 651 (1917). **Type:** Strezlecki Creek, Sep 1916, *R.Cockburn & S.A.White* (holo: AD; photo: BRI).

Illustrations: Hacker (1990: 113); Cunningham *et al.* (1981: 387); Jessop & Toelken (eds) (1986: 701, fig. 380a).

Leaves unifoliolate, rarely trifoliolate; petiole to 4.5 cm long. Racemes terminal, 5–35 cm long; flowers 20–52. Calyx lobes equal to or slightly longer than the tube. Keel petal 35–53 mm long.

Selected specimens: Western Australia. Geikie Gorge, 16 km NE of Fitzroy Crossing, Jun 1970, *Briggs* 3668 (DNA, NSW, PERTH); Millstream Station, May 1952, *Brockway s.n.* (PERTH); 36 km W of Doorwarrah, May 1995, *Cranfield* 9689 (PERTH); Piccaninny Creek road, Bungle Bungle N.P., Apr 1956, *Solomon* 787 (PERTH); Gibb River road, 51 km NNE of Karunje Stn, Jul 1991, *Streimann*



Map 3. Distribution of *Crotalaria cunninghamii* subsp. *cunninghamii*.

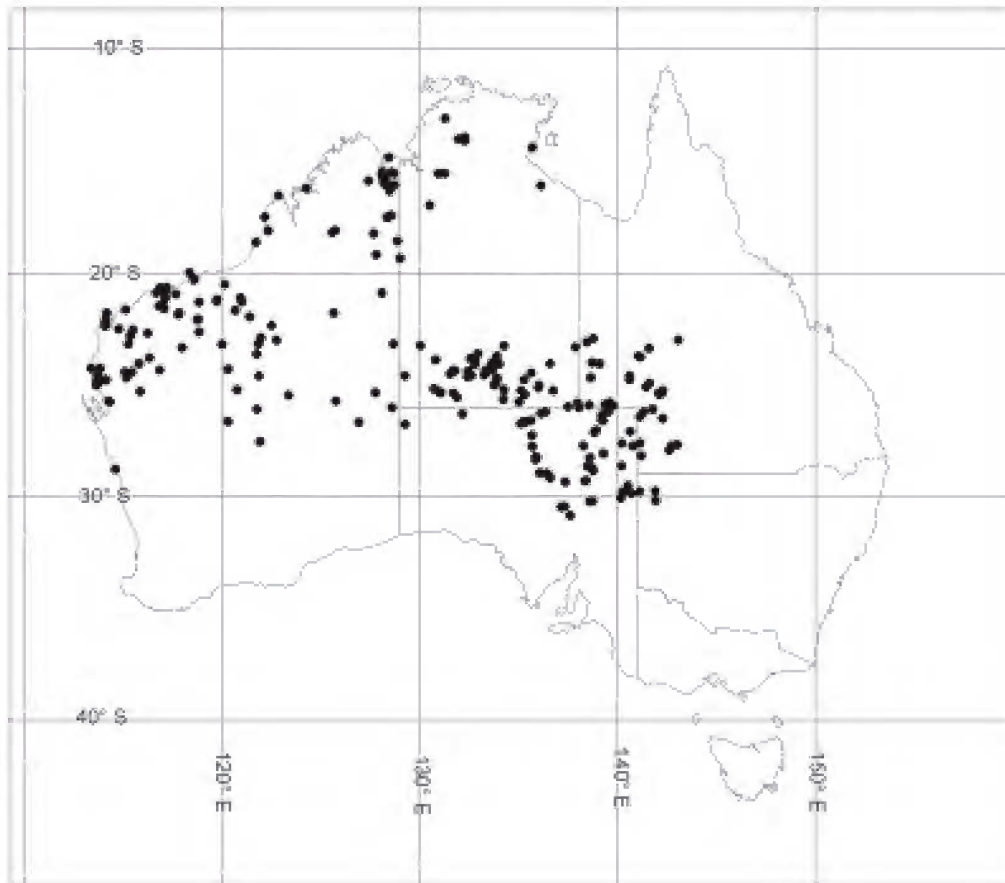
80027 (BRI, CANB, DNA). **Northern Territory.** 107 km from Tanami towards Gordon Downs, Aug 1971, *Gittins* 2385 (BRI); Hale River, Simpson desert, Aug 1977, *Latz* 7491 (DNA); c. 17 miles [27 km] NW of Andado Homestead, Jul 1968, *Must* 94 (AD, BRI, CANB, DNA). **South Australia.** Lake Cooragie, Innamincka Station, May 1966, *Smyth* 72 (AD); c. 8 km SW of William Creek, Sep 1986, *Weber* 9571a (AD, BRI); 40 km W of Hermannsburg, Jul 1954, *Chippendale* NT53 (DNA). **Queensland.** GREGORY NORTH DISTRICT: 164 km from Windorah on Bedourie road, May 1997, *Forster* PIF 20610 & *Holland* (BRI, MEL, NSW); Mulligan River, 18 km SW of Glenormiston Homestead, Oct 1984, *Neldner* 1560 (BRI). GREGORY SOUTH DISTRICT: Birdsville, Jan 1937, *Everist* 76 (BRI); Nockatunga Station, Jun 1936, *Blake* 11803 (BRI, CANB). WARREGO DISTRICT: 80 miles [128 km] W of Thargomindah, Sep 1963, *Cockburn* 46 (BRI). **New South Wales.** Milparinka, Feb 1910, *Forster s.n.* (NSW).

Distribution and habitat: Common throughout central Australia from Carnarvon in W.A. to Coopers Creek in Qld and as far south as Andamooka in S.A. Frequent on the crests of sand dunes, also found on sandy plains, and in drainage lines, on sandy soils. Map 4.

Phenology: Flowers all year, often after rain.

Discussion: Brown (1849) published these two names (*C. sturtii* and *C. cunninghamii*) on adjacent pages but gave greater prominence to the first name, *C. sturtii*. The type material of *C. sturtii* was collected from Central Australia. He described *C. cunninghamii* on the next page under “Obs” and distinguished it from *C. sturtii* by the “leaves simple, ovate to obovate, usually sericeous-tomentose, petiole apex curved, peduncle axillary, 1-flowered”. The type material of *C. cunninghamii* was collected from north-western Australia.

Hooker (1852) and Mueller (1862) believed the two names to be synonymous but gave no published references. Hooker stated that “in many respects this (*C. cunninghamii*) accords with Mr. Brown’s description of *C. sturtii*”. Mueller did not mention *C. sturtii* but his description of *C. cunninghamii* includes



Map 4. Distribution of *Crotalaria cunninghamii* subsp. *sturtii*.

material with single and many-flowered racemes: “racemis ...elongatis raro ad florem solitarium reductis”. Bentham (1864) placed *C. sturtii* in synonymy under *C. cunninghamii*: “The specimen of the latter (*C. cunninghamii*), and seen by R. Brown, having been imperfect as to inflorescence and there is nothing in R. Brown’s diagnoses of *C. sturtii* which does not agree perfectly with the common state of *C. cunninghamii*”.

Examination of current herbarium holdings revealed that a number of specimens from the north-west of Australia have short, few-flowered racemes. The remaining material, mostly from central Australia, has long, many-flowered racemes. Measurements of the lengths of the mature racemes of 476 specimens indicates 2 general groupings: racemes 0–3.5 cm long and racemes 5–31 cm long. On the

basis of these measurements and other supporting characters, as well as the distribution of the groupings, I conclude that these taxa are for the most part distinct. *C. sturtii* is therefore here recombined at the level of subspecies.

The type specimen of *C. cunninghamii* var. *trifoliolata* J.Black is here considered to be a rare trifoliolate form of *C. cunninghamii* subsp. *sturtii*. No other trifoliolate specimens were seen. The existence of trifoliolate and unifoliolate forms in the same species, and sometimes on the same plant, has been noted in the literature for other legumes e.g. *Desmodium* (Pedley 1999) and *Cullen* (Grimes 1997).

Lectotypification: The collections cited by Brown for *C. cunninghamii* are: **a.** North-west

coast of Australia (barren shores of Goodenough Bay, SE of Cygnet Bay, A. *Cunningham* (K, 3 specimens on one sheet); **b.** [Bynoe] *Wickham & Stokes' Voyage of the Beagle* (BM). The lower right hand specimen on the Kew sheet (sheet **a.**), is here selected as the lectotype.

8. *Crotalaria dissitiflora* Benth. in Mitch., J. Exped. Trop. Australia 386 (1848). **Type:** Baloon [Balonne] River, Nov 1846, *Mitchell* 459 (holo: K n.v.; photo: BRI, NSW).

Woody perennials to 60 cm; stem pubescent. Leaves trifoliolate; leaflets elliptic, lanceolate or obovate, 1–5 cm long, 0.5–1.5 cm wide, apex acute, obtuse or retuse; upper surface glabrous

or pubescent; lower surface pubescent; petiole 1–3.5 cm long; stipules subulate, 0.5–6 mm long. Racemes terminal, to 26 cm long; flowers 3–30; bract and bracteoles lanceolate, 0.5–3.5 mm long, caducous; bracteoles inserted just below calyx; pedicel 1–4 mm long. Calyx 2.5–6 mm long, appressed pubescent; lobes \pm equalling tube. Standard broadly ovate to suborbicular, apex rounded or emarginate, 6–15 mm long and wide, yellow, (with no other colours); wings oblong, shorter than or equalling keel; keel 7–17 mm long, beak not twisted. Pod shortly stipitate, oblong-clavate, oblique, 11–22 mm long, 4–8 mm wide, pubescent, with 6–12 seeds. Seed 2.5–3 mm long, brown or ochre.

Three subspecies are recognised here:

Key to subspecies of *Crotalaria dissitiflora* (adapted from Lee 1978):

1. Upper surface of leaflets always glabrous; keel 8–13 mm long **8a.** subsp. ***dissitiflora***
Both surfaces of leaflets pubescent; young leaflets usually bullate or rugose
in appearance from arrangement of pubescence at veins
2. Keel beak 7–13 mm long **8b.** subsp. ***rugosa***
Keel beak 13–17 mm long **8c.** subsp. ***benthamiana***

8a. *Crotalaria dissitiflora* Benth. subsp. ***dissitiflora***

Illustrations: Hacker (1990: 114); Hardin (1994, 2: 521); Jessop (ed) (1981: 153 fig. 175d).

Plants sparsely pubescent, hairs appressed, to 0.5 mm long. Leaflet lamina 1–5 cm long, 0.6–1.2 cm wide, apex acute, obtuse or retuse; upper surface glabrous and minutely dotted; petiole 2–3.5 cm long; stipules 2.5–6 mm long. Bract 1–3.5 mm long; pedicel 2–3 mm long. Calyx 2.5–5 mm long. Keel petal 8–13 mm long, beak straight or rounded. Pod 1.1–1.6 cm long, 4–8 mm wide. Fig. 3D.

Selected specimens: Northern Territory. 17 miles [27 km] W Arltunga, Mar 1958, *Chippendale* NT4080 (DNA, PERTH). S.A.: Congie sand hills, King's lookout, Oct 1986, *Conrick* 2017 (AD, HO); 5 miles [8 km] W Tarlton Downs Homestead, Feb 1968, *Latz* 158 (DNA, MEL); 12 miles [19.2 km] N Mittibar Homestead, Mar 1981, *Maconochie* 2598 (CANB, DNA). Queensland. BURKE DISTRICT: 35 miles [56 km] NNE Camooweal, May 1948, *Perry* 997 (CANB). WARREGO DISTRICT: Cunnamulla, Apr 1936, *Blake* 11212 (BRI, CANB); Gilruth Plains near Cunnamulla, Apr 1863, *McKee* 10313 (BRI, CANB, NSW). LEICHHARDT DISTRICT:

Peak Downs, Jun 1951, *Everist* 4405 (BRI, CANB); 82 km SW of Mt Coolon, Mar 1995, *Fensham* 2698 (BRI). New South Wales. Moree, Feb. 1969, *Mactier* (NSW).

Distribution and habitat: Occurs in southern Qld, N.S.W. and the southern part of the N.T., on heavy black clay soils, in open woodland and grassland. **Map:** Lee (1978: 330, Map 1).

Phenology: Flowers most of year.

8b. *Crotalaria dissitiflora* subsp. ***rugosa*** (Benth.) A.T.Lee, *Telopea* 1(5): 332 (1978); *Crotalaria dissitiflora* var. *rugosa* Benth., *Fl. Austral.* 2: 184 (1864). **Type:** Sturts Creek, Feb. 1886, *F.Mueller* (lecto, here designated: K, n.v.; photo: BRI, NSW; isolecto: MEL[MEL1010367]).

Illustration: Williams (1984: 90).

Plants moderately to densely pubescent, hairs loosely appressed, shining, to 2 mm long. Leaflet lamina 1–4 cm long, 0.5–1.3 cm wide, apex rounded or retuse; young leaflets usually bullate or rugose in appearance from arrangement of pubescence at veins; petiole

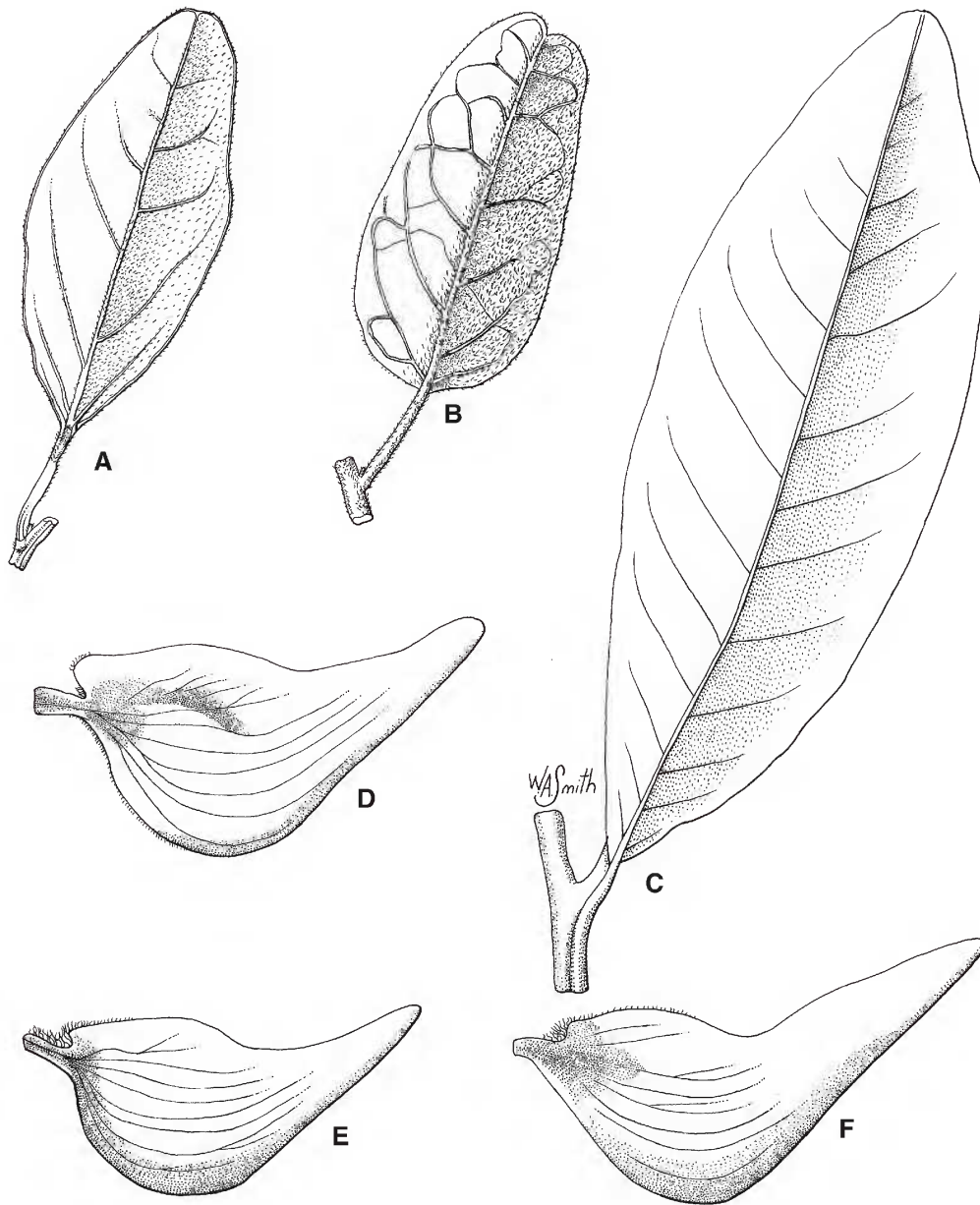


Fig. 3. A. *Crotalaria novae-hollandiae* subsp. *novae-hollandiae*, leaf $\times 1$. B. *C. novae-hollandiae* subsp. *lasiophylla*, leaf $\times 1$. C. *C. novae-hollandiae* subsp. *crassipes*, leaf $\times 1$. D. *Crotalaria dissitiflora* subsp. *dissitiflora*, keel petal $\times 4$. E. *Crotalaria dissitiflora* subsp. *rugosa*, keel petal $\times 4$. F. *Crotalaria dissitiflora* subsp. *benthamiana*, keel petal $\times 4$. A: Purdie 1036 (BRI). B: Thomas 662 (BRI). C: Maconochie 1591 (BRI). D: Nelson 2353 (CANB). E: Kimbel 48 (DNA). F: Forrest s.n. (MEL).

1.8–2.6 cm long; stipules linear, 0.5–5 mm long. Bract 0.5–2.2 mm long; pedicel 1–4 mm long. Calyx 3–4 mm long. Keel petal 7–13 mm long, beak straight or rounded. Pod 1.2–1.9 cm long, 4–8 mm wide. Fig. 3E.

Selected specimens: **Northern Territory.** Bishop's Bore, 17 miles [27 km] NW of Brunette Downs Homestead, Oct 1958, *Chippendale* NT5011 (BRI, DNA, PERTH); 30 miles [48 km] SW of Tobermorey Homestead, Sep 1954, *Chippendale* NT393 (BRI, CANB, DNA, NSW); 16 miles [25.6 km] E of Alcoota Stn, Mar 1953, *Perry* 3395 (BRI, DNA, CANB, PERTH); 1 km N of No. 11 Bore, Aug 1984, *Strong* 505 (DNA). **Queensland.** BURKE DISTRICT: 20 km N of Julia Ck, Mar 1977, *Pullen* 10.415 (BRI, CANB). MITCHELL DISTRICT: 15 miles [24 km] W of Hughenden on Richmond road, May 1956, *Burbidge* 5378 (CANB). GREGORY NORTH DISTRICT: 110 km N of Birdsville, Sep 1951, *Pedley* 4478 (AD, BRI, MEL). **South Australia.** c. 30 km N of Innamincka, Jun 1986, *Archer* s.n. (AD).

Distribution and habitat: Tropical and subtropical Australia, from the Kimberley district of W.A., across the N.T., and in western Qld. Occurs on a variety of clay soils, usually in open woodland or grassland. **Map:** Lee (1978: 330, Map 1).

Phenology: Flowers most of year.

Lectotypification: Bentham (1864) cites two collections for var. *rugosa*: **a.** Sturt's Creek, *F. Mueller* (K, MEL [MEL1010367]) and **b.** Newcastle Water, *F. Mueller* (MEL [MEL1010366]). Specimen **a.** Sturt's Creek, *F. Mueller* at K is here chosen as the lectotype. This specimen is the most complete of the two **a.** sheets and specimen **b.**

8c. *Crotalaria dissitiflora* subsp. *benthamiana* (Pritzell) A.E.Holland comb. nov.

Crotalaria benthamiana Pritzell in Diels & Pritzell, Bot. Jahrb. Syst. 35: 267 (1904); *Crotalaria dissitiflora* var. *grandiflora* Benth., Fl. Austral. 2: 184 (1864). **Type:** "Hammersley Range", F. Gregory's Expedition, *M. Brown* [MEL1010368] (neo, here designated: MEL photo: BRI).

Plants moderately to densely pubescent; hairs loosely appressed, shining, c. 2 mm long. Leaflet lamina 1.5–4 cm long, 0.5–1.4 cm wide, apex rounded; young leaflets usually bullate or rugose in appearance from

arrangement of pubescence at veins; petiole 1–3 cm long; stipules 2–6 mm long. Bract 1–2 mm long; pedicel 2–4 mm long. Calyx 4–6 mm long; keel petal 13–17 mm long, beak straight. Pod 15–22 mm long, 6–7 mm wide. Fig. 3F.

Specimens examined: **Western Australia.** Port Hedland, Aug 1963, *Beard* 2861 (PERTH); Fortescue River, 1878, *Carey* s.n. (MEL); Between Port Hedland and Mt Tom Price, Mar 1970, *Donovan* s.n. (BRI); Jones Creek and George River south of Roebourne, undated, *Forrest* [MEL1727397] (MEL); Nickol River, 1878, *Forrest* s.n. (MEL); Between Onslow and Roebourne at Karratha Station, Dampier, Sep 1968, *Godlonton* s.n. (PERTH); Karratha Station, between Onslow and Roebourne, Oct 1968, *Fitzgerald* s.n. (PERTH); Wittenoom, on Port Hedland road, Jul 1964, *Garstone* s.n. (PERTH); Port Walcott, undated, *Harper* s.n. (PERTH); near Barowanna Hill, Mar 1984, *Newbey* 9966 (PERTH); 3 km S of Mt Florence Homestead, May 1996, *Mitchell* PRP1034 (BRI, PERTH); Port Hedland, 1973, *Stone* s.n. (PERTH).

Distribution and habitat: Known from the Fortescue district of W.A. with one specimen from Port Walcott. Occurs on "crabhole" plains of red basalt derived soil. **Map:** Lee (1978: 330, Map 1).

Phenology: Flowers February to October.

Discussion: Lee (1978) distinguished *C. benthamiana* Pritzell from *C. dissitiflora* Benth. by the large flowers (15–17 mm long) which have a straight-beaked keel (not incurved). This taxon is also geographically isolated and occurs on a distinct soil type, "red basaltic soils of the Pilbara". However, in her notes, Lee stated that "the status of this taxon is debatable; vegetatively it is indistinguishable from *C. dissitiflora* subsp. *rugosa* although their flowers are virtually constant and different from one another."

Recent collections of *C. dissitiflora* include specimens from both Qld and the N.T. which have larger flowers (keel 10–13 mm long). These large-flowered forms occur in both subspecies, and both of Lee's keel shapes are represented e.g. subsp. *dissitiflora*: rounded keel, *Perry* 997 (CANB); long, straight-beaked keel, *Maconochie* 2598 (CANB, DNA); subsp. *rugosa*: rounded keel, *Burbidge* 5378 (CANB); long, straight-beaked keel, *Strong* 505 (DNA).

Keel lengths were measured for 346 flowers from 75 specimens across all three taxa (including large flowered forms) yielding a continuous range of lengths from 7 to 17 mm.

Crotalaria benthamiana represents one end of the variation (fig. 3D–F) and is therefore here recombined at the level of subspecies.

Neotypification: Pritzel described *C. benthamiana* as a new species but indicated in his notes that it was based on *C. dissitiflora* var. *grandiflora* Benth. Pritzel's designated type "in the tropical region on the shore of Nickol Bay midway to Spring Station" (B) is presumed destroyed. Lee (1978) selected a lectotype for *C. benthamiana* from among Bentham's *C. dissitiflora* var. *grandiflora* syntypes. However, none of these specimens were actually cited by Pritzel. Therefore neotypification, rather than lectotypification is required. In order to avoid further confusion, I here designate Lee's "lectotype": Hammersley Range, F. Gregory's Expedition, M.B. (MEL [MEL1010368]) as the neotype for *C. benthamiana*.

9. *Crotalaria novae-hollandiae* DC., Prod. 2: 127 (1825). Type: "in Nova-Hollandia

orient" (G-DC n.v. [fiche: BRI]).

Perennial herbs or shrubs to 2 m; stem pubescent. Leaves unifoliolate; lamina broadly elliptic to narrowly oblong, 2–17 cm long, 0.5–8 cm wide, apex acute, obtuse or retuse; upper surface glabrous or pubescent; lower surface pubescent; petiole 5–20 mm long; stipules lanceolate, 1–5 mm long. Racemes to 35 cm; flowers 5–50; bract lanceolate, 1–4 mm long; bracteoles c. 1 mm long, inserted on the pedicel near the middle; pedicel 2–11 mm long. Calyx 4–8 mm long, appressed pubescent; lobes triangular, shorter or longer than tube. Standard ovate, obovate or suborbicular, 7–18 mm long, yellow, veins reddish-brown; wings equal to or shorter than keel; keel 8–16 mm long, beak twisted. Pod stipitate, oblong-clavate, 17–36 mm long, 4–14 mm wide, glabrous or pubescent; seeds 6–10. Seed 3.5–6 mm long, yellow-brown.

Three subspecies are recognised here.

Key to subspecies are *Crotalaria novae-hollandiae*

1. Whole plant glabrous, often glaucous; petioles 2–8 mm long; ridged, ridge decurrent; flowers 5–20; calyx lobes slightly longer than tube **9c. subsp. *crassipes***
Plants pubescent at least on stem, petioles and peduncles; petiole 6–20 mm long, not ridged or decurrent; flowers 10–50; calyx lobes longer or shorter than tube
2. Both surfaces of leaflet lamina densely pubescent, hairs often ferruginous; base rounded or cordate; veins forming an angle of 70°–90° to the midrib; bracteoles inserted at or above the midpoint of the pedicel **9b. subsp. *lasiophylla***
Upper surface of leaflet lamina pubescent or glabrous; lower surface appressed pubescent, hairs usually white; base rounded to cuneate, apex variable; veins forming an angle of 30°–60° to the midrib; bracteoles on lower half of pedicel **9a. subsp. *novae-hollandiae***

9a. *Crotalaria novae-hollandiae* DC. subsp. *novae-hollandiae*

Illustrations: Hacker (1990: 121); Wheeler *et al.* (eds) (1992: 389, fig. 116a); Williams (1984: 90).

Plants to 1.5 m; stem pubescent. Leaflet lamina elliptic, ovate, obovate, lanceolate or oblong, 3–13 cm long, 0.5–4 cm wide, apex acute, obtuse or retuse, base rounded or cuneate; upper surface glabrous, or both surfaces appressed pubescent; veins forming an angle of 30°–60° from the midrib; petiole 6–20 mm long, not

ridged or decurrent. Racemes to 33 cm; flowers 10–50; bracteoles inserted on lower half of pedicel. Calyx 4–6.5 mm long; lobes equal to or shorter than tube. Standard 7–18 mm long; keel 8–15 mm long. Pod glabrous or sparsely pubescent. Seed 3.5–5 mm long. Fig. 3A

Selected specimens: **Western Australia.** Mable Downs, May 1984, Winnama Spring, 17.5 km S of Turkey Creek, May 1984, *Forbes* 2011 (BRI, CANB, MEL, PERTH); Bungle Bungle N.P., Osmond Ck, W of Osmond Yard, June 1989, June 1989, *Menkhorst* 399 (DNA, PERTH); Miles Bore, Feb 1992, *Mitchell* 2064 (DNA, PERTH). **Northern Territory.** 30.2 miles [48 km] S of Katherine, Sept 1957, *Chippendale* 3738 (AD. CANB, DNA, PERTH, MEL); 22

miles [35.5 km] NNE of New Tanumirini Homestead, June 1971, *Latz* 1400 (CANB, DNA); 16 miles [25.6 km] E Tarlton Downs, Apr 1967, *Maconochie* 109 (CANB, DNA); 2 miles [3.2 km] N of Katherine, Feb 1961, *McKee* 8526 (CANB, DNA, NSW); Great Northern Highway, 27 km N of Turkey Creek, Apr 1987, *Purdie* 3312 (CANB, MEL). **Queensland**. BURKE DISTRICT: Mica Creek, Mt Isa, Oct 1967, *Braithwaite* 3335 (CANB); 6 miles [9.6 km] S of Boomarra Station, Aug 1953, *Perry* 3985 (BRI, CANB, DNA, PERTH).

Distribution and habitat: Northern Australia, from the Dampier Peninsula in W.A., throughout the N.T., and in northern Qld. Occurs in woodland, shrubland and grassland, on a variety of soil, often near streams or rivers. Map: Lee (1978: 349: Map 3).

Phenology: Flowers all year.

9b. *Crotalaria novae-hollandiae* subsp. *lasiophylla* (Benth.) A.T.Lee, *Telopea* 1(5): 19–356 (1978); *Crotalaria novae-hollandiae* f. *lasiophylla* Benth., *Fl. Austral.* 2: 182 (1864). **Type:** “near Mt. Humphries”, *McDouall Stuart* [MEL1010378] (lecto: MEL, fide Lee (1978); photo: BRI).

Illustrations: Wheeler *et al.* (eds) (1992: 389, fig. 116b); Jessop & Toelken (eds) (1986: 701 fig. 380a).

Plants to 1.5 m; stem pubescent. Leaflet lamina elliptic, ovate or obovate, 2–10 cm long, 1–4.5 cm wide, apex obtuse or retuse, base rounded or cordate; both surfaces densely pubescent, usually with ferruginous hairs; veins having an angle of 70°–90° to the midrib; petiole 4–17 mm long, not ridged or decurrent. Racemes to 24 cm; flowers 10–35; bracteoles usually inserted at or above the midpoint of the pedicel. Calyx 6–7 mm long; lobes, equal to or shorter than tube. Standard 9–17 mm long; keel 8–15 mm long. Pod pubescent. Seed 3.5–5 mm long. Fig. 3B

Selected specimens: Western Australia. Near Frog Bore, Bohemia Downs, Apr 1972, *Aplin* 4754 (AD, CANB, MEL, PERTH); Taylor’s Lookout, 40 km S Lamboo Homestead, Oct 1972, *Aplin* 5209 (PERTH); Fitzroy River, Apr 1953, *Gardner* 10153 (AD, CANB, MEL, PERTH); Just W of Wolf Creek Crater, Apr 1979, *George* 15307 (CANB, DNA, PERTH). **Northern Territory.** 15.4 miles [24 km] E of The Granites, Nov 1965, *Chippendale* NT4275 (AD, DNA, MEL); Pingelly Waterhole, Kurundi Station, Feb 1972, *Dunlop* 2490 (DNA, CANB); 6 miles [9.6 km] S Alice Springs, Dec 1969, *Nelson* 1985 (AD, DNA, MEL); Lenners

Rock, 1 mile [1.6 km] N, Nov 1954, *Winkworth* 34 (BRI, CANB, MEL, PERTH). **Queensland.** BURKE DISTRICT: 8.3 km E Mussellbrook Mining Camp on main southern road to Camooweal 175 km N of Camooweal, May 1995, *Johnson* MRS979 (BRI); 0.6 miles [0.8 km] N of Deep Well Siding, Aug 1964, *Nelson* 1270 (CANB, DNA, PERTH); Gregory River Crossing c. 20 miles [32 km] SW of Burketown, Jun 1966, *Pedley* 2067 (BRI, CANB). **South Australia.** 1 km from Purni Bore, Jul 1984, *Badman* 1350 (AD, CANB); Sand dune adjacent to Purni Bore & 56 km E of Dalhousie Springs, Sept 1974, *Symon* 9408 (AD, CANB).

Distribution and habitat: Throughout the N.T. and adjacent areas of W.A. and Qld, and the northern edge of S.A. Occurs in open woodland, shrubland or grassland, in sandy soil. Map: Lee (1978: 349: Map 3).

Phenology: Flowers September to December.

9c. *Crotalaria novae-hollandiae* subsp. *crassipes* (Hook.) A.E.Holland comb. nov.

Crotalaria crassipes Hook. in Hooker’s *Icon. Pl.* 9: t. 830 (1852). **Type:** N.W. coast, *Bynoe* (holo: K; photo: BRI).

Illustrations: Hooker (1952: 8, t.830)

Plants to 2 m, glabrous, often glaucous. Leaf lamina 5–17 cm long, 2–8 cm wide, apex variable, base rounded to cuneate; upper surface pubescent or glabrous, lower surface appressed pubescent, hairs usually white; veins forming an angle of 30°–60° to the midrib; petiole 2–8 mm long, ridged and decurrent. Racemes to 35 cm long; flowers 5–20; bracteoles inserted on lower half of pedicel. Calyx 6–8 mm long; lobes slightly longer than tube. Standard 12–18 mm long; keel 12–16 mm long. Pod glabrous. Seed 4–6 mm long. Fig. 3C.

Selected specimens: Western Australia. 11.5 km by road N of Kalumburu on road to Pago Mission, May 1985, *Aplin* 890 *et al.* (PERTH); Wanjana N.P., Aug 1982, *Conrick* 1082 (AD); Charnley River, 4 km upstream of junction with Calder River, May 1983, *Dale* 5 (PERTH); Leopold Range, Gibb River road, W.A., Nov 1981, *Dunlop* 6020 & *Done* (DNA, MEL, PERTH); Mellarie Creek, 5 km N Drysdale Homestead where Gibb River road crosses this creek, Jun 1992, *Mitchell* 2577 (DNA, PERTH); Kuri, S end of peninsula, Vansittart Bay, Mar 1993, *Mitchell* 2925 (CANB, PERTH); 14 km N Napier Range, May 1975, *Symon* 10139 (AD, CANB, PERTH); Heywood Island, May 1972, *Wilson* 10897 (PERTH). **Northern Territory.** 6 km W Mitchell River Falls, Apr 1993, *Cowie* 4355 & *Brubacker* (CANB, DNA, MEL); Mount Brockman, Apr 1980, *Dunlop* 5500 (CANB,

DNA); Mudginberri Station, May 1982, *Dunlop* 6162 & *Taylor* (DNA, MEL); between Cahill's Crossing and Oenpelli, May 1973, *Hartley* 13728 (CANB, DNA); Narbarlek, Apr 1988, *Hinz* 4 (BRI, CANB); 7 miles [11 km] E Rum Bottle Creek, Jun 1972, *Maconochie* 1591 (BRI, CANB, DNA); Kakadu N.P., 6 km SW Mount Brockman, Apr 1980, *Telford* 8066 & *Wrigley* (CANB); Gregory N.P., Apr 1996, *Walsh* 4516 (MEL); 27 km E Goomadeer Crossing, Arnhem Land, Jun 1987, *Wightman* 3823 (DNA).

Distribution and habitat: Coastal areas in northern and western Australia from the Kimberley district in W.A. and as far east as the Calvert River in the N.T. Occurs in open woodland and grassland, on slopes, creek banks and sand dunes, in sandy soils. Map: Lee (1978: 349: Map 3).

Phenology: Flowers from February to October.

Discussion: *C. crassipes* was first described by Hooker in 1851 as a "most distinct and well marked species" based on material collected on the north-west coast of Australia. Bentham (1864) retained this species, distinguishing it from the closely related *C. novae-hollandiae* by the total lack of hairs, the subulate stipules and the decurrent petiole-ridges. Lee (1978) disagreed with this distinction because "...the few specimens seen by me differ from *C. novae-hollandiae* only in being glabrous." She placed *C. crassipes* in synonymy under *C. novae-hollandiae*.

With further material now available it is evident that *C. crassipes* is, for the most part, distinct, distinguished by the absence of hairs, the petiolar ridges and shorter petiole (fig. 3A–C). However, there are a number of intermediate forms from the Northern Territory: **a.** glabrous and nearly glabrous specimens of *C. novae-hollandiae* subsp. *novae-hollandiae*: between the Calvert River and Calvert Hills Station, May 1974, *Pullen* 9243 (CANB, DNA), 3 miles [4.8 km] W of

Calvert River Crossing, May 1974, *Carolin* 9257 (NSW) and **b.** specimens of *C. novae-hollandiae* subsp. *lasiophylla* which have petiole-ridges and short petioles: King Ash Bay, McArthur River, May 1984, *Thomson* 678 (DNA), Davenport Range, Old Elkedra Homestead, May 1977, *Latz* 6977 (CANB, NSW). *C. crassipes* is therefore here recombined at the level of subspecies.

10. *Crotalaria montana* Heyne ex Roth, Nov. Pl. Sp. 335. 1821. Type: East India, *Heyne s.n.*, *Wallich* 5384 (syn: K, n.v. (photo at BRI)).

Crotalaria linifolia auct. non L.f.: Bentham (1864, 180); Bailey (1900, 373); Stanley & Ross (1983, 275) (see discussion below).

Erect annual or perennial herb to 1 m; stem appressed pubescent or subglabrous. Leaves simple, narrowly oblong or linear, 20–80 mm long, 2–7 mm wide, L:W ratio 5–24:1, apex acute or obtuse; upper surface glabrous or both surfaces shortly appressed-pubescent; petiole to 2 mm long; stipules absent. Racemes 10–60 cm long; flowers 7–35; bract and bracteoles linear, 1.5–2.5 mm long; bracteoles inserted on the calyx; pedicel 2–5 mm long. Calyx 5–7 mm long, somewhat 2-lipped, pubescent; upper lobes joined nearly to apex. Corolla equalling the calyx; standard suborbicular, emarginate, 4.5–7 mm long, 3–6 mm wide, auriculate, pale yellow, veins reddish; outer surface pubescent on midrib; wings oblong, 4–7 mm long, equal to or shorter than keel; keel 5–7.5 mm long, 2.5–3.5 mm wide, beak twisted. Pod sessile, subglobose to cylindrical, 5–12 mm long, 4–5 mm wide, glabrous; seeds 8–16. Seed 1.3–2.7 mm long, black, brown or yellow-green.

Two varieties are recognised for Australia here.

Key to varieties of *Crotalaria montana* in Australia

Pod 5–8 mm long **10a. var. angustifolia**
Pod 8–12 mm long **10b. var. exserta**

Note: *C. montana* var. *montana* does not occur in Australia - see discussion below.

10a. *Crotalaria montana* var. *angustifolia* (Gagnep.) Niyomdham, Thai For. Bull. Bot. 11: 145 (1978); *Crotalaria linifolia* L.f. var. *angustifolia* Gagnep., Fl. Gen.

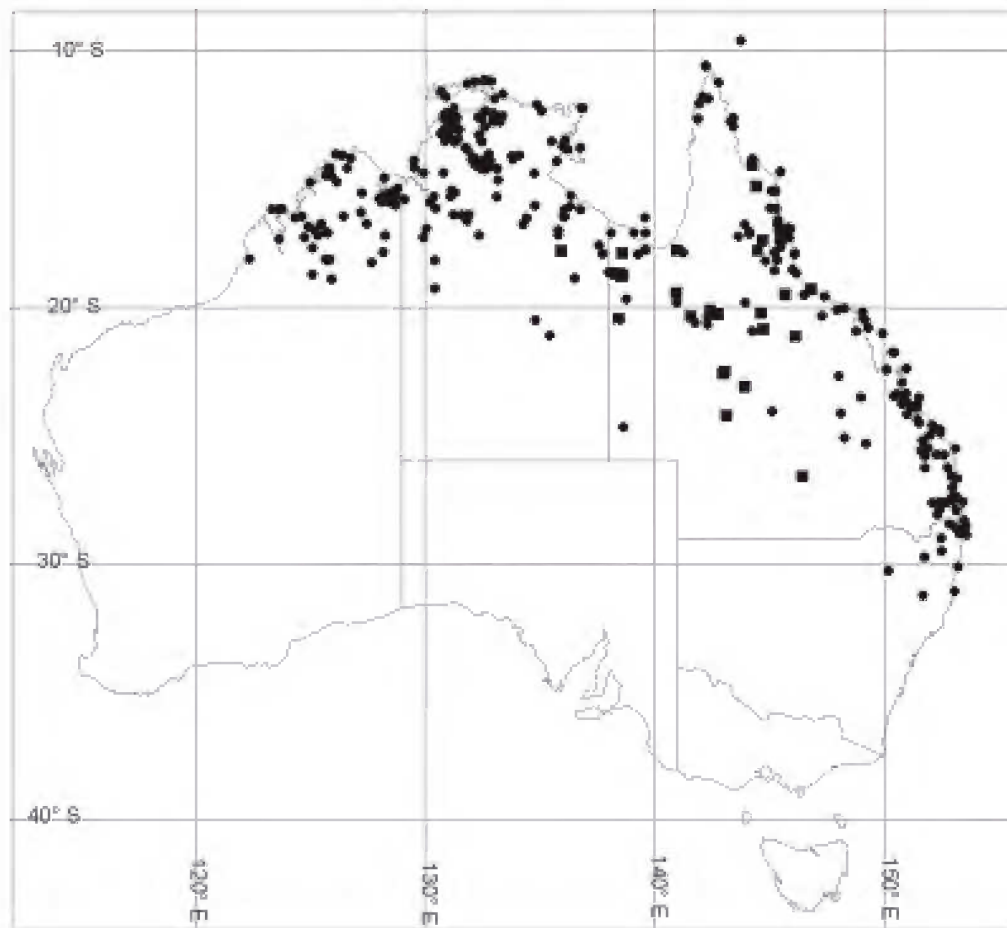
I.-C. 2: 332 (1916). **Type:** *Mieville* in *Chevalier* 37225 (holo: P, n.v.; photo: BRI).

Racemes 4–30 cm long. Pod subglobose to rhomboid, 5–8 mm long, slightly longer than the calyx. Fig. 2A,B.

Selected specimens: Western Australia. 19 km SE of East Wyndham, Kununurra road, Jul 1974, *Carr* 3236 & *Beaglehole* (CANB, PERTH); Mabel Downs, Winnama Gorge, 17.5 km S Turkey Creek, May 1984, *Forbes* 1987 (MEL, PERTH); Upper slopes of Cockburn Range, Mar 1978, *Hartley* 14605 (CANB, PERTH); 4 km SE of Beverley Springs Homestead, May 1979, *Muir* 651 (PERTH); 6 km S of Wyndham on road to Halls Creek, Apr 1977, *Pullen* 10.871 (CANB, PERTH); Christmas Creek Station, May 1962, *Royce* 6994 (CANB, PERTH); Koolan Island, Apr 1984, *Vernon* 50 (CANB, PERTH). **Northern Territory.** 2.5 miles [4.0 km] SW of Fountain Head, Mar 1061, *Chippendale* NT7696 (BRI, CANB, DNA, MEL, PERTH); Cobourg Peninsula, Popham Bay, Apr 1993, *Cowie* 3608 (DNA); 1 km N Borroloola, Mar 1979, *Henshall* 2659 (CANB, DNA); 75 miles [120 km] NE of Maraboy Police Station, Mar 1965, *Lazarides* 86 & *Adams* (CANB, DNA); 64 miles [102 km] NE of Tanami Bore, May 1971, *Maconochie* 1110 (AD, BRI, CANB, PERTH); Humpty Doo, Feb 1961, *McKee* 8304 (CANB, DNA, NSW); Limbunya Station, Base Camp, Jul 1949, *Perry* 2330 (BRI, CANB, DNA, MEL); Bickerton Island, South Bay, Jun 1948, *Specht* 538 (AD, BRI, CANB, MEL, NSW, PERTH).

Queensland. BURKE DISTRICT: Nicholson River crossing, Doomagee, May 1974, *Jacobs* 1440 (CANB, NSW). COOK DISTRICT: 21 km W of Cholmondeley Creek crossing on Telegraph Line road towards Skardon River, Mar 1992, *Johnson* 5165 (BRI, MEL). NORTH KENNEDY DISTRICT: Burdekin River area above Dalbeg, Apr 1975, *Staples* 2108 (BRI). LEICHHARDT DISTRICT: Carnarvon Gorge, 70 miles [112 km] NNW of Injune, Apr 1966, *McDonald* 211 (BRI). MITCHELL DISTRICT: 34 miles [54 km] NW of Longreach, Mar 1953, *Davidson* 346 (BRI). BURNETT DISTRICT: 14 km from Murgon, towards Nanango, Nov 1996, *Bean* 11381 (BRI, NSW). DARLING DOWNS DISTRICT: 6 km E of Maryvale, Mar 1995, *Fensham* 1960 (BRI). MORETON DISTRICT: Serpentine Creek & environs, 11 km NE of Brisbane, Mar 1973, *Durrington* 515 (BRI). **New South Wales.** Mount Sugarloaf, July 1969, *Clarke* 1830 (NSW); Kyogle to Woodenbong, Jan 1971, *Salasoo* 4574 (NSW).

Distribution and habitat: Across northern Australia from Broome in W.A., through the northern half of the N.T., throughout Qld, and in northern N.S.W. Also in SE Asia and New



Map 5. Distribution of *Crotalaria montana* var. *angustifolia* ● and *Crotalaria montana* var. *exserta* ■.

Guinea. Occurs in grassland and woodland in a variety of soils and situations. Map 5.

Phenology. Flowers December to September.

10b. *Crotalaria montana* var. *exserta* (Domin) A.E.Holland, **comb. nov.**

C. exserta Domin, *Biblioth. Bot.* 89 (2): 179 (1925). **Type:** Queensland: “in xerodrymio ad pedem montis Metal Mountains, apud opp. Chillagoe”, Feb 1910, *K.Domin* (lecto, here designated: PR [PR527125]); photo: BRI)

Racemes 10–60 cm long. Pod cylindrical, nearly twice the length of the calyx, 8–12 mm long. Fig. 2C.

Selected specimens: Queensland. BURKE DISTRICT: 8 km N of Riversleigh Homestead, Jun 1974, *Maconochie* 1943 (BRI, DNA); Lawn Hill N.P., Louie Creek, Apr 1997, *Forster* PIF 20854 & *Holland* (BRI, DNA); Ridgepole Waterhole, 27 km E Musselbrook Mining Camp, Apr 1995, *Johnson* MRS240 & *Thomas* (BRI); Canobie, c. 100 miles [160 km] NNE of Cloncurry, Apr 1954, *Everist* 5323 (BRI); 1.5 km NW of Magazine Hill, 10.4 km N of Silver Star Mine, Apr 1991, *Jones s.n.* (BRI); 35 km N of Julia Creek on the Normanton road, Mar 1977, *Pullen* 10.424 (BRI, CANB); Barkly Downs, May 1963, *Gittins* 789 (BRI); 84 km NE of Hughenden, 17 km NNW of Clyde Park Homestead, Mar 1993, *Thompson* HUG212 & *Henderson* (BRI). COOK DISTRICT: Gilbert River, undated, *Bick s.n.* (BRI); Eight Mile Swamp Area, Lakefield N.P., Jan 1993, *Bean* 5541 (BRI); 4 km E of Almaden on road to Petford, Mar 1980, *Clarkson* 3044 (BRI, DNA, PERTH); 73 km from Almaden on road to Mount Surprise, Jan 1992, *Forster* 9633 (BRI, MEL). NORTH KENNEDY DISTRICT: Snake Creek, c. 95 km NW of Charters Towers on Gregory Developmental road, Apr 1991, *Battanoff* SC9104009 & *Franks* (BRI); 30 miles [48 km] S of Townsville on western line, Mar 1964, *Robinson s.n.* (BRI). SOUTH KENNEDY DISTRICT: 4 km SW of Natal Downs, Jun 1991, *Thompson* 141 & *Henderson* (BRI). MITCHELL DISTRICT: Bald Hills Creek, Windgate Parade, Valetta, May 1991, *Emmott* 463 (BRI); 14 km NE of Prairie on edge of Flinders Hwy, Mar 1993, *Thompson* HUG293 & *Henderson* (BRI).

Distribution and habitat: Occurs in Queensland in the north-west and on Cape York Peninsula, as far south as Townsville, in grassland or open woodland with grassy understorey, on clay or clay loam soils near creeks and watercourses. This variety appears to be restricted to Australia. Map 5.

Phenology: Flowers and fruits January to June.

Discussion: *Crotalaria montana* and *C. linifolia* L. are closely related and both

names appear in the Australian literature. According to Verdcourt (1979), the Australian material is correctly identified as *C. montana*. Rudd (1991) distinguished the two species in Sri Lanka by flower length: *C. linifolia* has flowers c. 10 mm long and *C. montana* has flowers c. 7 mm long. Examination of photographs of the type material of *C. linifolia* confirms that the flowers are c. 10 mm long, longer than that of any Australian material. I conclude therefore that *C. linifolia sens. str.* does not occur in Australia.

Niyomdham (1978) described two varieties of *C. montana* for Thailand: **a.** var. *montana* which has calyx and standard limb 8–9 mm long, and **b.** var. *angustifolia* which has calyx and standard limb 5–7 mm long. According to this taxonomy, the Australian material is correctly identified as *C. montana* var. *angustifolia*.

The name *Crotalaria exserta* Domin was never adopted but a distinct taxon fitting Domin's (1925) description occurs in Queensland. According to Domin, *C. exserta* differs from *C. linifolia* (*C. montana*) “mainly in the pod which is twice the length of the calyx”. A number of robust specimens from north-west Queensland have pods more than 8 mm long but in other respects these resemble those of *C. montana*. Specimens with smaller pods, 6–8 mm long, also occur in this area. Pod lengths from 131 specimens were measured. *C. exserta* represents one end of the variation noted and is therefore here recognised as a variety of *C. montana*.

Lectotypification: Domin cited two collections in his protologue: **a.** “Mount Remarkable, apud. opp. Pentland”, Mar 1910, *K.Domin* (PR[PR527124]), and **b.** “in xerodrymio ad pedem montis Metal Mountains, apud opp. Chillagoe”, Feb 1910, *K.Domin* (PR[PR527125]). Specimen **b.**, which is more complete, is here chosen as the lectotype.

Section D: New taxa

11. *Crotalaria medicaginea* Lam., Enc. 2: 201 (1786). **Type: East India, *Sonnerat* (holo: P-La., n.v.; photo: BRI).**

Crotalaria trifoliastrum auct. non Willd.:

Bentham (1864, 183); Bailey (1900, 375) (see discussion below).

Annual or perennial herbs to 1 m; stem pubescent. Leaves trifoliolate; leaflets obovate, oblanceolate or linear, 5–60 mm long, 0.5–10 mm wide, apex obtuse, truncate or emarginate; upper surface glabrous; lower surface sparsely pubescent; petiole 1–15 mm long, shorter than leaflets; stipules linear-lanceolate, 1–5 mm long. Racemes to 35 cm long; flowers 4–40; bract linear-lanceolate, 1–2.5 mm long; bracteoles 0.3–1.5 mm long, inserted on the

pedicel; pedicel 1–5 mm long. Calyx 2–4 mm long, appressed pubescent; lobes triangular, slightly longer than tube. Standard ovate, obovate or suborbicular, acute or rounded, 3–8 mm long, 2.5–7 mm wide, yellow, veins reddish; wings oblong, 3–7 mm long, shorter than keel; keel 3–8 mm long, beak twisted. Pod sessile, subglobose to rhomboid, 3–5.5 mm long and wide, appressed-pubescent, beak c. 1 mm long; seeds 2. Seed 1.5–2.5 mm long, olive-brown or yellow.

Three varieties are recognised here.

Key to varieties of *Crotalaria medicaginea*

1. Leaflets 0.5–3 mm wide, L:W ratio 13–35:1 **11c. var. linearis**
 Leaflets 1–10 mm wide, L:W ratio 2–15:1 2
2. Plants ascending, to 30 cm; calyx 2–3 mm long; keel 3–4.5 mm long; pod
 3–4 mm long **11a. var. medicaginea**
 Plants mostly erect, to 1 m; calyx 2.5–4 mm long; keel 4–7.5 mm long;
 pod 4–5.5 mm long **11b. var. neglecta**

11a. *Crotalaria medicaginea* var. *medicaginea*

Illustration: Niyomdham (1978: 174, fig. 11, B1)

Ascending herb to 30 cm high; much branched from near base. Leaflet lamina obovate to oblanceolate, 5–20 mm long, 2–8 mm wide, L:W ratio 2–6:1, apex obtuse, truncate or emarginate; stipules 1–2 mm long. Racemes to 9 cm long; bract 1–2 mm long; bracteoles 0.5–1 mm long; pedicel 1–2 mm long. Calyx 2–3 mm long. Standard ovate, acute, 3–4.5 mm long, 2.5–3.5 mm wide; keel 3–4.5 mm long. Pod 3–4 mm long.

Selected specimens: **Western Australia.** Gibb River road, c. 8 km S of turnoff to Mount House Station, May 1985, *Aplin 1013 et al.* (PERTH); **Northern Territory.** Katherine Gorge, Jun 1970, *Briggs 3689* (NSW); Cotton Island, May 1988, *Cowie 2975* (DNA); Port Essington, West Bay, Apr 1993, *Cowie 3426* (DNA); Blue Mud Bay, Benyella, May 1993, *Dunlop 9439 & Leach* (DNA); Eva Valley Station, Mar 1991, *Evans 3640* (DNA); Melville Island, Apr 1986, *Johnson 4182* (BRI); South Alligator River, 180 km E of Darwin, May 1974, *Pullen 9415* (CANB); Little Lagoon, Groote Eylandt, Apr 1948, *Specht 250* (AD, BRI, MEL, NSW); Port Bradshaw, Jul 1948, *Specht 707* (AD, BRI, MEL, NSW); Delissaville, Cox's Peninsula, Mar 1948, *Specht 136* (AD, BRI). **Queensland.** COOK DISTRICT: Lockerbie 10 miles [16 km] WSW of Somerset, Apr 1948, *Brass 18382* (BRI, CANB); c. 4.2 km SW of Herberton on Silver Valley road, May 1983, *Conn 1167 & Clarkson* (BRI, MEL); 11.1 km S of Batavia Downs on Peninsula Development road, Apr 1990, *Clarkson*

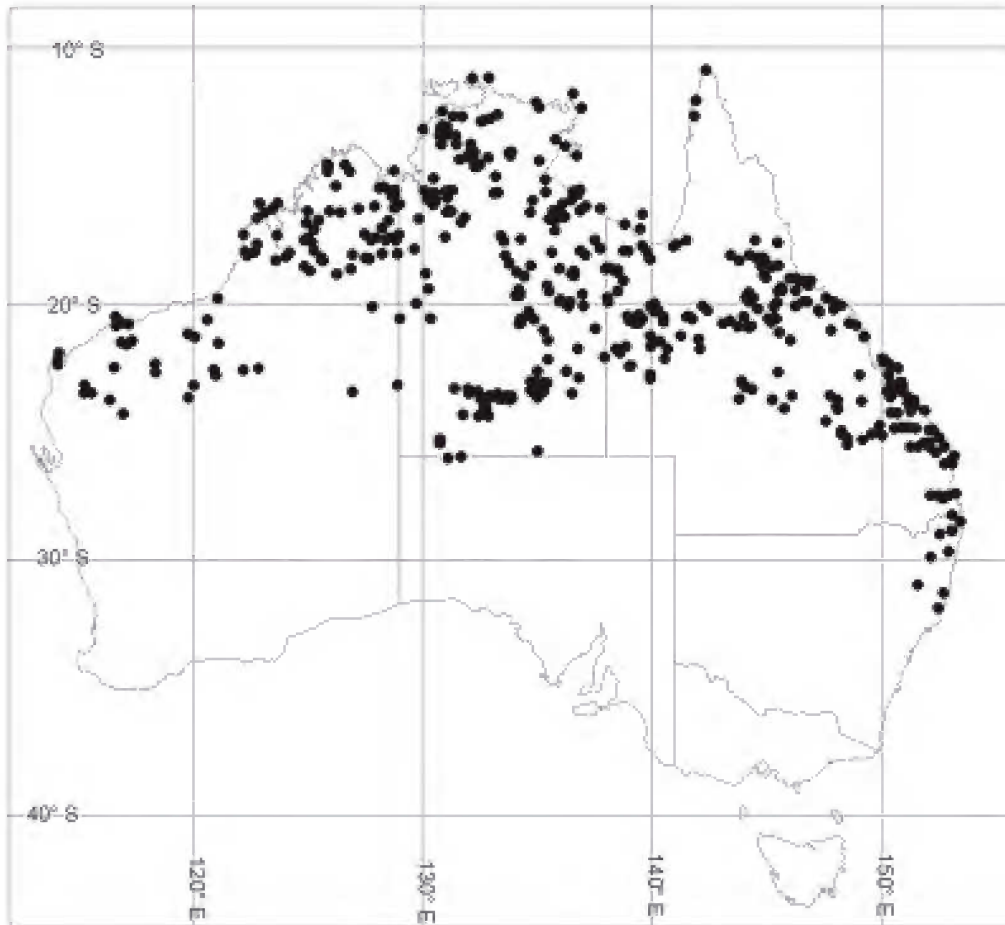
8287 & *Neldner* (BRI, NSW); Walsh River crossing c. 11 km NW of Rookwood Homestead, Jun 1983, *Conn 1337 & de Campo* (BRI, CANB, MEL, NSW); Yorkey's Knob Beach, near Cairns, Apr 1962, *McKee 9015* (BRI, NSW); Mappoon, near mouth of Wenlock River, Aug 1990, *Waterhouse BMW 1142A* (BRI). NORTH KENNEDY DISTRICT: Junction of Cooloomon and Little Cooloomon Creeks, May 1962, *Whitehouse s.n.* (BRI); SFR 461 c. 5 km NW of Cardwell, W of Mount Elphinstone, May 1976, *Thorsborne 209 & Thorsborne* (BRI). SOUTH KENNEDY DISTRICT: Myrtle Creek, near Proserpine, undated, *Michael 1166* (BRI); Bowen, Mar 1999, *Forster PIF 24199 & Booth* (BRI).

Distribution and habitat: Northern Australia, from the W.A. coast, across the top of the N.T. and on Cape York and the east coast of Qld as far south as Bundaberg. Occurs mainly on the coast and islands, in open eucalypt forests, woodlands and grasslands and on coastal dunes, in a variety of soils. Map 6.

Phenology: Flowers and fruits February to September.

11b. *Crotalaria medicaginea* var. *neglecta* (Wight & Arn.) Baker, in Hook.f., Fl. Br. Ind. 2 :81 (1876); *Crotalaria neglecta* Wight & Arn., Prod. Fl. Pen. Ind. Or. 1: 192 (1834). **Type:** India, *Wallich 5434* (holo: K; photo: BRI).

Crotalaria medicaginea var. *australiensis* Domin, Biblioth. Bot. 89 (2): 180



Map 6. Distribution of *Crotalaria medicaginea* var. *neglecta*.

(1925). **Type:** Brisbane River, *Dietrich* 915 (lecto, here designated: PR [PR 527137]; isolecto: NSW; photo: BRI).

Crotalaria medicaginea var. *angustata* Domin, *Biblioth. Bot.* 89 (2): 180 (1925). **Type:** Lappa Junction, Feb. 1910, *K. Domin* (lecto, here designated: PR [PR 527148]; photo: BRI).

Illustrations: Hacker (1990: 119); Hardin (ed.) (1994: 2: 521); Dunlop *et al.* (eds) (1995: 63, fig. 19).

Erect herb to 1 m; stem usually single at base. Leaflets obovate to oblanceolate, 5–40 mm long, 1–10 mm wide, L:W ratio 2–15:1, apex obtuse, truncate, or emarginate; stipules 1–5

mm long. Racemes to 35 cm long; bract 1–2.5 mm long; bracteoles 0.5–1.5 mm long; pedicel 1.5–5 mm long. Calyx 2.5–4 mm long. Standard ovate to obovate or suborbicular, acute or rounded, 5–8 mm long, 4–6 mm wide; keel 4–8 mm long. Pod 4–5.5 mm long.

Selected specimens: **Western Australia.** Upper Carawine Gorge c. 1 km N of road crossing of main channel of Oakover River, Aug 1977, *Barker* 2077 (AD, PERTH); 103 miles [165 km] E of Langely's crossing on Fitzroy River, May 1967, *Bennett* 1936 (CANB, PERTH); On the plateau just above the Ord River near Ivanhoe Crossing 10.5 km NNW of Kununurra, Apr 1977, *Eichler* 22178 (CANB, DNA, PERTH); 19 miles [30 km] SSW of Mabel Downs Station, Apr 1955, *Lazarides* 5059 (BRI, PERTH); Kimberley Research Station, Jul 1952, *Perry* 3037 (BRI, CANB, DNA, MEL, PERTH). **Northern Territory.** 13 miles [21 km] S of White Quartz Hill Homestead, Aug 1959, *Chippendale* NT6526 (AD, BRI, CANB, DNA, MEL, PERTH);

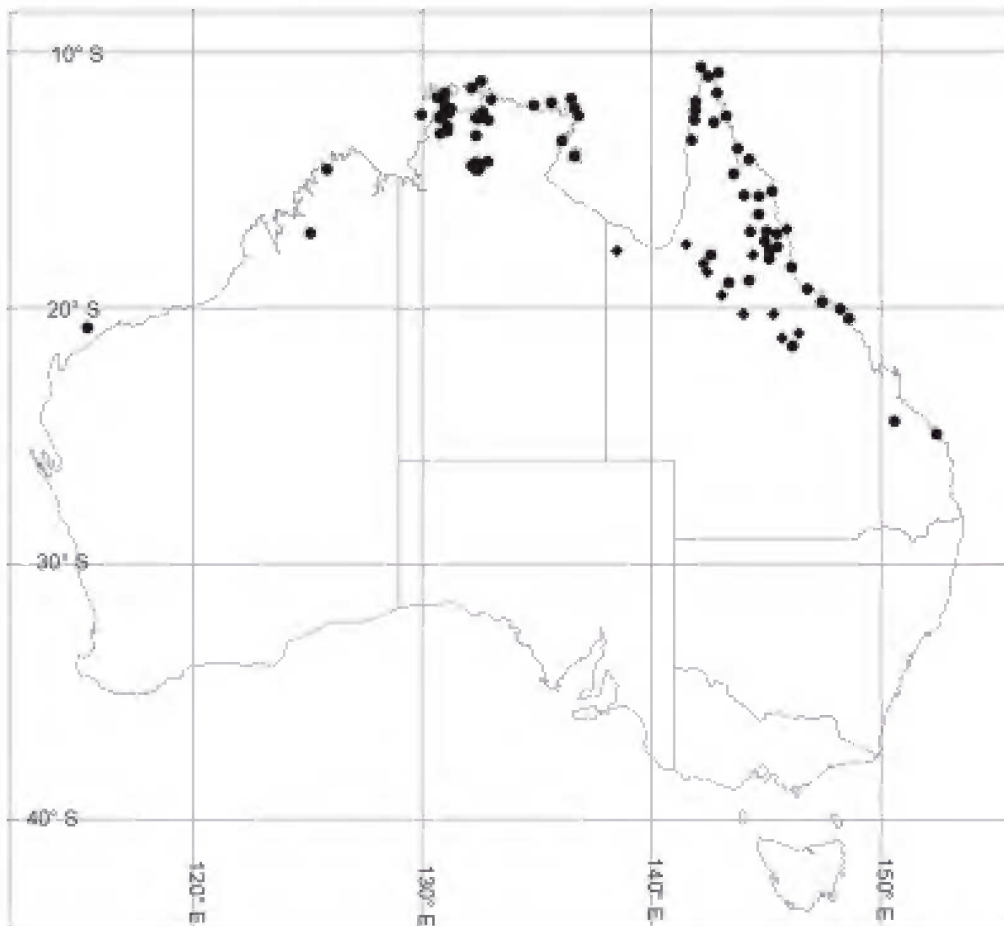
McArthur River area, Amelia Springs, Jan 1976, *Craven* 3532 (CANB, DNA); Palm Valley, Dec 1968, *Latz* 396 (AD, CANB, DNA); 15 km NNW of Seven Emu, May 1985, *Leach* 637 (CANB, DNA, MEL); 15 miles [24 km] N of Katherine, Feb 1961, *McKee* 8552 (DNA, NSW); 17 miles [27 km] E of Pine Creek, Apr 1962, *Nelson* 277 (AD, DNA, MEL); Edith River Siding 0.5 miles [0.8 km] NW, Jan 1965, *Wilson* 221 (BRI, CANB, NSW). **Queensland.** BURKE DISTRICT: 9 miles [14 km] N of Mount Isa on Barkly Hwy, Jul 1974, *Kratzing* PO 1185 & *Ollerenshaw* (BRI, CANB). COOK DISTRICT: Newcastle Range, 64 km from Mount Surprise on Georgetown road, Mar 1988, *Forster* PIF 3815 (BRI). NORTH KENNEDY DISTRICT: Pentland, Jan 1982, *Pedley* 4815A (BRI, CANB, MEL). LEICHHARDT DISTRICT: Allambic near Springsure, Feb 1960, *Johnson* 1295 (BRI, CANB). MITCHELL DISTRICT: End of Poison Valley road, White Mountains N.P., Apr 1992, *Bean* 4337 (BRI). PORT CURTIS DISTRICT: 25.5 km by road SW of Rockhampton from Mount Morgan turnoff, on Bruce Hwy, Feb 1987, *McKenzie* 19 (BRI). GREGORY NORTH: Douglas Downs c. 55 miles [88 km] W of Dajarra, Sep 1951, *Everist* 4478 (AD, BRI). MARANOVA DISTRICT: Mount Debateable, Jun 1915, *Bick* s.n. (BRI,

NSW). MORETON DISTRICT: Alice Creek, 7.5 km ESE of Murphy's Creek rail siding, Aug 1990, *Forster* PIF 7108 (BRI, NSW, MEL). **New South Wales.** Taree, Jun 1964, *Noonan* s.n. (NSW). **South Australia.** Mount Woodward, May 1983, *Bates* 3080 (AD); 59 km SE of Bedford Downs Station, Jun 1975, *Symon* 10317 (AD).

Distribution and habitat: Widespread across northern Australia from North-West Cape in W.A., throughout the N.T. and throughout Qld. Also in a few places in northern N.S.W., as far south as Taree. Occurs mostly in open *Eucalyptus* and *Acacia* woodland or grassland, on hillsides, creek banks and gullies, usually in sandy or gravelly soil. Map 7.

Phenology: Flowers and fruits most of the year.

11c. *Crotalaria medicaginea* var. *linearis*
A.E.Holland, var. nov., a varietatibus



Map 7. Distribution of *Crotalaria medicaginea* var. *medicaginea* ● and *Crotalaria medicaginea* var. *linearis* ◆.

ceteris foliolis angustioribus 0.5–3 mm latis et L:W ratione 13–35:1 differt.

Typus: Queensland. BURKE DISTRICT: 70 km NW of Hughenden, 22 Mar 1993, *E.J. Thompson* HUG 350 & *R.J. Henderson* (holo: BRI).

Erect slender herb to 60 cm; stem usually single at base. Leaflets linear, 15–60 mm long, 0.5–3 mm wide, L:W ratio 13–35:1, apex acute; stipules 0.5–2 mm long. Racemes to 24 cm long; bract 1–2 mm long; bracteoles 0.3–0.5 mm long; pedicel 1.5–3 mm long. Calyx 2–3 mm long. Standard ovate, acute, 5–7 mm long, c. 5 mm wide; keel 5–7 mm long. Pod 3.5–4.5 mm long.

Specimens examined: Queensland. BURKE DISTRICT: Croydon, Aug 1936, *Blake* 12453 (BRI); About halfway between Croydon and “Esmeralda”, Jul 1954, *Blake* 19603 (BRI); Between the Norman and Gilbert Rivers, 1874, *Gulliver* 75 (MEL); 23 km NW of Corinda Homestead, Westmoreland road, May 1974, *Jacobs* 1504 (CANB, NSW); Between Normanton and Kuranda, May 1976, *Scarth-Johnson* 128A (BRI). COOK DISTRICT: Cairns, May 1960, *Lavers s.n.* (BRI). NORTH KENNEDY DISTRICT: Gorge Creek, on old Pentland-Torrens Creek road, Apr 1989, *Cumming* 8966 (BRI). SOUTH KENNEDY DISTRICT: Cape River Crossing, 266 km N of Clermont, Charters Towers road, Jul 1983, *Hacker* BH327 (BRI); Darkies Range, 20 km NNE of Yarrowmere, Jun 1991, *Thompson* 94 & *Henderson* (BRI).

Distribution and habitat: Occurs only in north-western Qld, from the border to Charters Towers. Grows in *Melaleuca* seasonal swamps or open *Eucalyptus* woodland, often on creek banks, in sandy soil. Map 7.

Phenology: Flowers and fruits from March to August.

Discussion: *Crotalaria trifoliastrum* Willd. is a name that has been variously applied in the Australian literature (summarised by Lee 1978). Lee concluded that *C. trifoliastrum* is an “erect, large-flowered subshrub of limited geographical range in India” and that the Australian material is correctly referred to *C. medicaginea*. Examination of photographs of the type specimen of *C. trifoliastrum* and further specimens at Kew (examined by Les Pedley and Rod Seppelt) has confirmed Lee’s description of *C. trifoliastrum* as a subshrub with large flowers c. 10 mm long. However, Lee did not mention, and perhaps did not see, specimens from north Queensland which also

have large flowers, similar to those of *C. trifoliastrum* (*C. aridicola* - see below). Specimens of *C. trifoliastrum* examined at Kew also had consistently long petioles (longer than the leaflets), an observation which appears in Willdenow’s original description (1802) as well as descriptions by Wight & Arnott (1834) and Baker (1879). Australian material of both *C. aridicola* and *C. medicaginea* has petioles consistently shorter than the leaflets and the name *C. trifoliastrum* is therefore not applied to Australian material at this time.

Crotalaria medicaginea Lam. has been applied to a widespread taxon occurring in S.E. Asia and India. Baker (1879) described 3 varieties in it: **a.** var. *herniarioides* (Wight & Arn.) Baker (stem prostrate, leaflets small, with L:W ratio c. 1:1, peduncles short 1–3 flowered); **b.** var. *neglecta* (Wight & Arn.) Baker (robust, ascending, racemes of 6–9 flowers, leaflets larger); **c.** var. *luxurians* (Benth.) Baker (stem 2–3 feet, petiole ½ inch, terminal leaflet ¾ – 1 inch, racemes of 6–12 flowers). Niyomdham (1978) and others placed var. *luxurians* in var. *neglecta* and it is this taxonomy which is followed here. The type material of Domin’s var. *australiensis* and var. *angustata*, is not distinguishable from that of var. *neglecta*. These names are therefore treated as synonyms of *C. medicaginea* var. *neglecta* here. However, because of the many syntypes cited by Domin, lectotypification for these names is presented here.

Lectotypification: *C. medicaginea* var. *australiensis*. Ten collections cited by Domin in his protologue: **a.** Tambourine Mts, Mar 1910, *K.Domin* (not seen); **b.** Brisbane River, *A. Dietrich* 915, (PR [PR 527137]); ditto, 2784 (not seen); ditto, 1358 (not seen), NSW; **c.** Rockhampton, *Dietrich s.n.* (not seen); **d.** Emu Park, Rockhampton, Mar 1910, *K.Domin* (PR, 2 sheets [PR527138, PR527141]); **e.** Pentland, Feb–Mar 1910, *K.Domin* (PR [PR527140]); **f.** Hughenden, Feb–Mar 1910, *K.Domin* (not seen); **g.** Barcaldine, Feb–Mar 1910, *K.Domin* (PR [PR 527145]); **h.** Flinders River bei Hughenden, Feb–Mar 1910, *K.Domin* (PR [PR527139]). Specimen **b.** is here chosen as lectotype. It best represents the coastal form of *C. medicaginea* var. *neglecta*, which has slightly broader leaflets than do inland forms.

C. medicaginea var. *angustata*. Two syntypes were cited by Domin in his protologue: **a.** Chillagoe district, Feb 1910, *K. Domin* (PR, 2 sheets [PR527149, PR527147]) and **b.** Lappa Junction, Feb 1910, *K. Domin* (PR [PR 527148]). Specimen **b.** is here chosen as lectotype. It represents the northern form of *C. medicaginea* var. *neglecta*, which has smaller leaflets.

12. *Crotalaria aridicola* Domin, *Biblioth. Bot.* 89 (2): 180 (1925). **Type:** Queensland. “in colle Metal Mountains apud opp. Chillagoe”, Feb 1910, *K. Domin* (lecto, here designated: PR [PR527150]; photo: BRI) (see discussion below).

Erect perennial herb or subshrub to 1 m; stem pubescent, hairs spreading or appressed. Leaves trifoliolate; leaflets obovate to oblanceolate, 7–50 mm long, 1–15 mm wide,

apex acute, obtuse or emarginate; upper surface glabrous or sparsely pubescent; lower surface sparsely to densely pubescent; petiole 3–15 mm long, shorter than leaflets; stipules linear, 1.5–6 mm long. Racemes to 30 cm long; flowers 3–50; bract linear-lanceolate, 1.5–5 mm long; bracteoles 1–2 mm long, inserted on the pedicel; pedicel 2–5.5 mm long. Calyx 3.5–7 mm long, pubescent; lobes narrowly triangular, longer than tube. Corolla longer than the calyx, yellow, veins reddish; standard ovate or suborbicular, acute or obtuse, 8–14 mm long and wide; wings oblong, shorter than keel; keel 7–14 mm long, beak twisted. Pod sessile, rhomboid, 5–7 mm long and wide, densely pubescent, beak 1–3 mm long; seeds 2. Seed 1.5–2.8 mm long, oblique cordiform, dark brown.

Three subspecies are recognised here.

Key to subspecies of *Crotalaria aridicola*

1. Leaves crowded on stem; leaflets 1–5 mm wide, L:W ratio 5–32:1 **12c.** subsp. **densifolia**
Leaves not crowded; leaflets 3–8 mm wide; L:W ratio 2–5:1 2
2. Indumentum on stems, pods and lower surface of leaflets spreading,
hairs 0.5–1 mm long **12a.** subsp. **aridicola**
Indumentum on stems, pods and lower surface of leaves appressed,
hairs 0.1–0.5 mm long **12b.** subsp. **glabrata**

12a. *Crotalaria aridicola* Domin subsp. **aridicola**

Stem densely pubescent; hairs spreading, 0.5–1 mm long. Leaflets obovate to oblanceolate, 12–33 mm long, 3–15 mm wide, L/W ratio 2–5, obtuse or emarginate; upper surface sparsely pubescent; lower surface densely pubescent, veins obscure. Calyx 5–7 mm long, densely pubescent; lobes nearly twice the length of the tube. Standard broadly ovate, acute, 9–10 mm long, 7–8 mm wide, wings 8–9 mm long; keel 9–12 mm long. Pod densely pubescent; beak 2–3 mm long. Fig. 4A–C.

Selected specimens: Queensland. COOK DISTRICT: Chillagoe, Apr 1938, *Blake* 13635 (BRI); 10 km SE of Mungana on Burke Development road, Feb 1980, *Clarkson* 2830 (BRI); Copperfield River, Kidston Goldmine Water Supply dam, Gilbert Range, Feb 1994, *Forster* PIF 14779 (BRI); 10 km from Almaden on road to Mount Surprise, Jan 1992, *Forster* PIF 9588 (BRI); 90 km from Georgetown, Mount Surprise road, Jul 1983, *Hacker* BH373 (BRI); 8 km from Lynd, Einasleigh-Forsyth road, Jul 1983, *Hacker* BH353 (BRI); Mutchilba, Jan 1962, *Pedley* 4833 (BRI);

Near Chillagoe, Jan 1982, *Pedley* 4852 (BRI); Burlington Station, Feb 1950, *Ryley* s.n. (BRI); 10 km NE of Ravenswood, Leichhardt Range, Sep 1991, *Thompson* 501 (BRI); BURKE DISTRICT: Townley Homestead, river flat of Robertson River, Nov 1981, *Mitchell* s.n. (BRI); Near Burketown, May 1976, *Scarth-Johnson* 28A (BRI); NORTH KENNEDY DISTRICT: Maida Vale, E of Mingela, Apr 1991, *Bean* 2953 (BRI); Cardington, c. 40 miles [64 km] S of Townsville, May 1954, *Everist* 5519 (BRI); Harvey’s Range road, 19 km SW Keelbottom Creek crossing, Apr 1980, *Williams* 80003 (BRI).

Distribution and habitat: Occurs in north Queensland from Burketown to Mount Carbine and as far south as Ravenswood. Grows on hill slopes in open *Eucalyptus* woodland on sandy or loamy soils usually derived from granite or limestone, often in disturbed areas. Map 8.

Phenology: Flowers and fruits most of the year.

12b. *Crotalaria aridicola* subsp. **glabrata**
A.E. Holland, **subsp. nov.** a subsp. *aridicola* pilis brevioribus appressis 0.1–0.5 mm longis differt et a subsp.

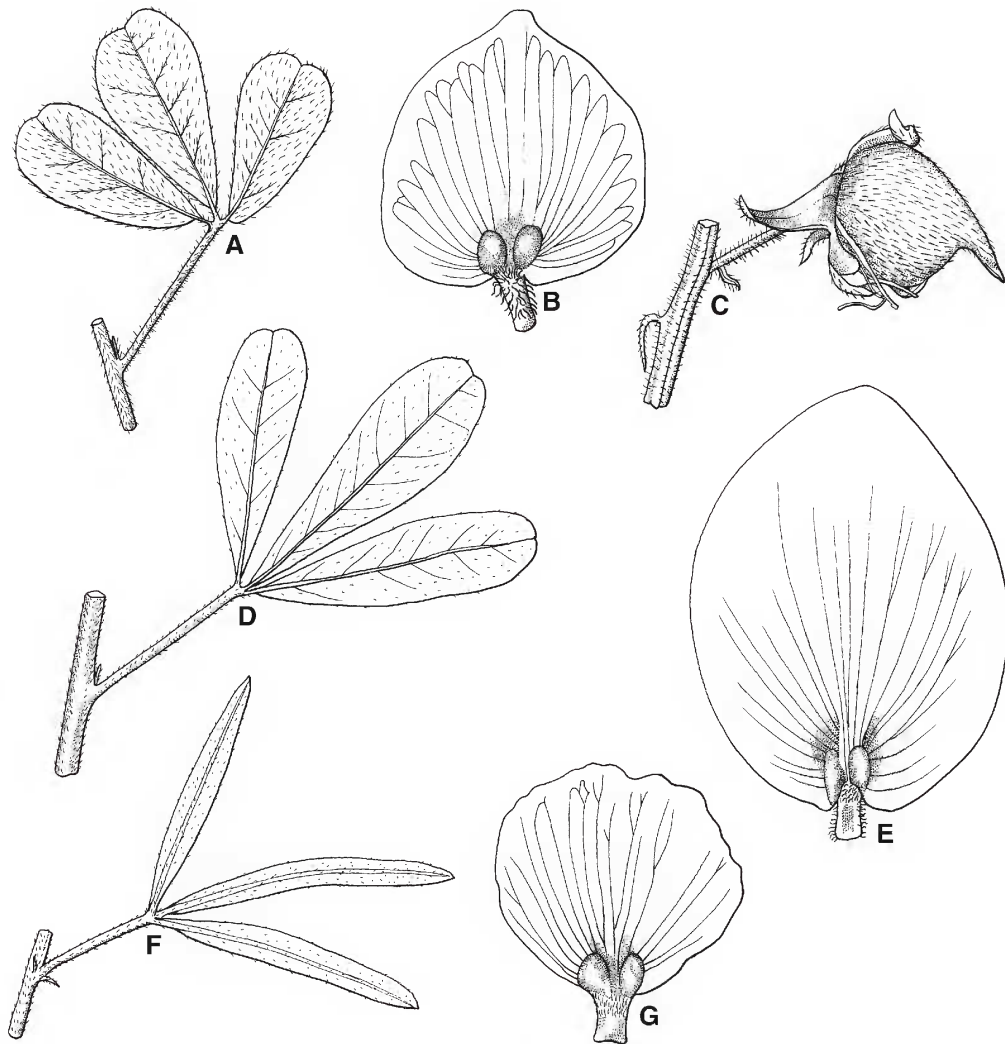


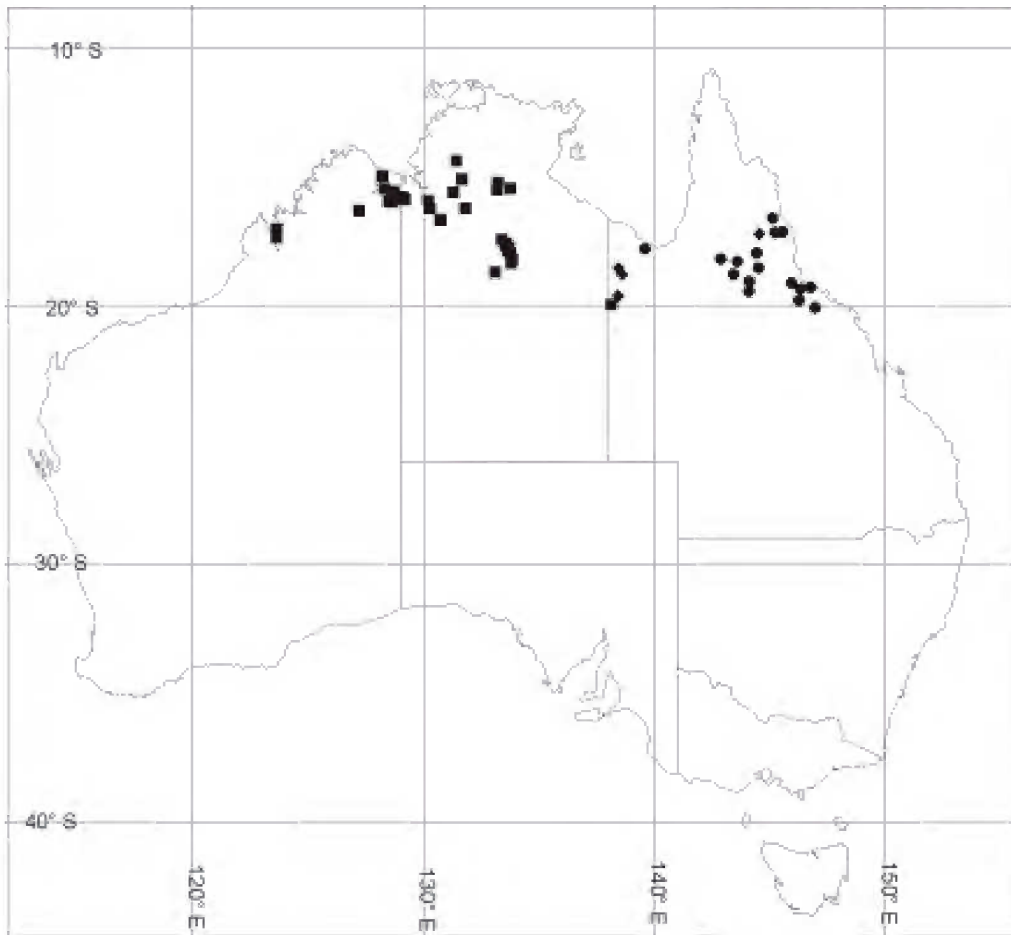
Fig. 4. A–C: *C. aridicola* subsp. *aridicola*. A. leaf $\times 2$. B. standard petal $\times 4$. C. pod $\times 4$. D,E: *Crotalaria aridicola* subsp. *glabrata*. D. leaf $\times 2$. E. standard petal $\times 4$. F, G: *Crotalaria aridicola* subsp. *densifolia*. F. leaf $\times 2$. G. standard petal $\times 4$. A–C: Clarkson 7940 (BRI). D,E: Clarkson 3034 (BRI). F,G: Maconochie 577 (BRI).

densifolia foliolis latioribus (3–9 mm latis et L:W ratione 2–5:1) differt. **Typus:** Queensland. BURKE DISTRICT: Lawn Hill National Park, Colless Creek, Apr 1997, *P.I. Forster* PIF 20890 & *A.E. Holland* (holo: BRI; iso: DNA, MEL).

Stem moderately to densely pubescent or nearly glabrous; hairs appressed, to 0.5 mm long. Leaflets obovate, 7–28 mm long, 3–9 mm wide, L:W ratio 2–5:1, apex obtuse or emarginate; upper surface glabrous; lower surface appressed pubescent, veins visible. Calyx 4–6 mm long,

appressed pubescent; lobes slightly longer than the tube. Standard ovate to suborbicular, acute or obtuse, 9–14 mm long, 7–14 mm wide; wings 8–13 mm long; keel 8–14 mm long. Pod appressed pubescent; beak 2–3 mm long. Fig. 4D–E.

Selected specimens: Queensland. BURKE DISTRICT: Lost City, 2.7 km S of Ridgepole Waterhole, 27 km E of Musselbrook Mining Camp, 17.5 km N of Camooweal, *Johnson* MRS268 & *Thomas* (BRI, MEL); E of Jump-up 33.6 km E of Musselbrook Mining Camp, 175 km N of Camooweal-Lawn Hill N.P., May 1995, *Johnson* MRS1000 & *Thomas* (BRI, DNA); Gulf of Carpentaria, undated,



Map 8. Distribution of *Crotalaria aridicola* subsp. *aridicola* ●, *Crotalaria aridicola* subsp. *glabrata* ◆ and *Crotalaria aridicola* subsp. *densifolia* ■.

Landsborough [MEL2038697] (MEL): Adels's Grove, via Camooweal, undated, *de Lestang* 273 (BRI); COOK DISTRICT: Chillagoe, near "Dorothy" Mine, May 1983, *Godwin* C2444 (BRI); Chillagoe Station, Mungana, May 1983, *Lewis s.n.* (BRI). NORTH KENNEDY DISTRICT: Townsville, undated, *Betche* 1901 (NSW); Magnetic Island, Horseshoe Bay, Mar 1935, *Blake* 8274 (BRI, CANB); Palleranda Town Common, Jan 1962, *Copeman* 30 (BRI); 2 km SSE of Wunjunga, Mar 1989, *Cumming* 8722 (BRI); Heatley's Parade, Jan 1964, *Jacks* 3 (AD, BRI); Magnetic Island, undated, Cleveland Bay, *Gulliver* 1886 (MEL); Townsville Town Common, Jan 1968, *Henderson* H 330 (BRI); Saunders Beach, 18 km NW of Townsville, Apr 1975, *McDonald* 1442 & *Batianoff* (BRI).

Distribution and habitat: Occurs across northern Queensland, from Mussellbrook (north of Camooweal), to Cape Pallaranda near Townsville. Grows in open *Corymbia*, *Eucalyptus* and *Terminalia* woodland on

shallow stony or sandy soil, often in limestone areas. Map 8.

Phenology: Flowers and fruits from December to May.

12c. *Crotalaria aridicola* subsp. *densifolia*
A.E.Holland, **subsp. nov.** a subspeciebus ceteris foliolis angustioribus (1–5 mm latis et L:W ratione 5–32:1) differt.
Typus: Northern Territory. 21 miles [34 km] S Elliott, Stuart Hwy, Feb 1969, *J. Must* 361 (holo: CANB; iso: BRI, DNA).

Stem often woody, sparsely pubescent; hairs appressed, to 0.5 mm long. Leaves crowded on stem; leaflet lamina linear to narrowly oblong, 10–50 mm long, 1–5 mm wide, L:W

ratio 5–32:1, apex obtuse or acute; upper surface glabrous or sparsely pubescent; lower surface appressed pubescent, veins visible. Calyx 3.5–6 mm long, appressed pubescent; lobes slightly longer than tube. Standard broadly ovate to suborbicular, rounded, 8–12 mm long and wide; wings 7.5–9 mm long; keel 7–11 mm long. Pod appressed pubescent; beak 1–2 mm long. Fig. 4F–G.

Selected specimens: **Western Australia.** 14.8 km S of Great Northern Hwy, 62 km SSW of Derby, Jun 1976, *Beaglehole* 53026 (PERTH); E boundary track on Mirima N.P., Jan 1994, *Graham* 15 (PERTH); Headwaters of Packsaddle Creek, northern Carr Boyd Range, Mar 1978, *Hartley* 14333 (CANB, PERTH); c. 80 km E of Broome on Broome–Derby road, May 1967, *Jackson* 970 (CANB); Road to Kununurra from CSIRO Research Station, Jan 1968, *Leutert* 50 (CANB, PERTH); Kununurra–Carlton Station road, Apr 1977, *Pullen* 10.900 (CANB, PERTH); Kununurra, Jun 1975, *Symon* 10324 (AD, PERTH). **Northern Territory.** 10 miles [16 km] N Maryfield Homestead, Mar 1969, *Byrnes* 1409 (BRI, DNA); Gregory N.P., c. 28 km SW of Bullita Outstation on direct line of East Baines River, Apr 1996, *Coles* 87 (MEL); 27.7 miles [44.3 km] N Larrimah, May 1960, *Chippendale* NT6976 (DNA, CANB, MEL); 4.8 km N of Newcastle Waters, Jul 1974, *Carr* 2677 (DNA, MEL); 32 km from Renner Springs on Elliot road, Jun 1973, *Gittins* 2554 (BRI, DNA, NSW); 1.5 km W of No. 7 Bore, Newcastle Waters Station, *Henshall* 2594 (CANB, DNA); Elliot, Stuart Hwy, 25 Aug 1993, *Lally* 107 (CANB, DNA); c. 83 km NE of Green Swamp Well No.4, Aug 1986, *Leach* 874 (AD, BRI, CANB); Keep River N.P., Flying Fox Creek, Sep 1992, *Munns* 46 (DNA); 21 km SW Humbert River, Wickham Gorge, Jul 1977, *Parker* 1021 (DNA, CANB); 15 miles [24 km] N of Helen Springs, Sep 1947, *Perry* 127 (CANB); Claravale, Mar 194, *Robinson* D384 (DNA). **Queensland.** BURKE DISTRICT: Camooweal, Aug 1968, *Pocock s.n.* (AD).

Distribution and habitat. Across northern Australia from Broome in W.A., across the N.T. and as far east as Camooweal near the Qld–N.T. border. Occurs in low open woodland or herbland associated with *Acacia*, *Eucalyptus* and *Triodia*, in red sandy soil or clay loam on sandy plains or rocky creek beds. Map 8.

Phenology: Flowers and fruits all year.

Discussion: *Crotalaria aridicola* subsp. *aridicola* is very densely hairy with spreading hairs. The two new subspecies, *Crotalaria aridicola* subsp. *glabrata* and *C. aridicola* subsp. *densifolia*, are distinguished by their short appressed indumentum. Both have leaflets with a glabrous or nearly glabrous upper surface. *Crotalaria aridicola* subsp. *densifolia* is distinguished by the crowded

leaves and narrow leaflets. The three subspecies have somewhat overlapping distributions (see map 8).

Crotalaria aridicola, as presently understood, is endemic in Australia but is closely related to *C. trifoliatrum*, differing from that species by its petioles which are shorter than the leaflets (see discussion under *C. medicaginea*). *Crotalaria aridicola* subsp. *densifolia* superficially resembles *C. willdenowiana* DC. but this species has smaller flowers (6–8 mm long) and pods (c. 4 mm long).

Lectotypification: Three collections were cited by Domin in his protologue of *Crotalaria aridicola*, all from the Chillagoe area; **a.** “in den Savannenwaldern zwischen Chillagoe und den Metal Mtns”, Feb 1910, *K.Domin* (PR, 2 sheets [PR527150 and PR527151]); **b.** auf Karstkalk des Smelling Bluff”, Feb 1910, *K.Domin* (PR [PR527152]); **c.** “Calficer etc.”, Feb 1910, *K.Domin* (PR [PR527153]). The specimen from collection **a.**, sheet PR527150, is the largest and most complete specimen of the taxon and is here chosen as the lectotype of Domin’s name.

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